SUPPLEMENT TO "CURRENT SCIENCE"

Vol. IX] SEPTEMBER 1940 [No. 9

HIS HIGHNESS MAHARAJA SRI JAYA CHAMARAJA WADIYAR BAHADUR

ACCORDING to predictive astrology the conjunction and the relative disposition of certain planets in the Zodiac offer the most auspicious occasion for the performance of the prescribed *shastraic* ceremonies and the installation of the king on the *Gadi*. Such a propitious moment occurred on Sunday, 8th September 1940, at 10-30 A.M., when, after the due solemnization of the formalities, His Highness Maharaja Sri Jaya Chamaraja Wadiyar Bahadur ascended the jewelled throne of his ancestors, amidst scenes of pomp and general rejoicing.

His Highness was born on 18th July 1919. The education and bringing up of the young prince was an object of constant solicitude to his uncle and his father who devoted personal attention to minute detail. An English gentleman of wide experience, Mr. J. T. Turner, was appointed for the purpose of teaching and general supervision, with a staff of tutors for guidance in formal studies. Leading a regular and healthy life under kind but strict discipline, the prince, who displayed a natural and precocious disposition towards learning, made rapid progress. It may be said that even this early education and training were directed to induce such a healthy tone of mind and body as to prepare him to fill with credit and distinction the place of eminence and responsibility, which he would in the future be called upon to occupy. Later he proceeded to keep his terms at the university, where his intellectual and social gifts soon earned for him the popularity and esteem of his professors and fellow-students. An educational institution is an epitome of the larger life of the population, and presents infinite opportunities for an observant student to study those intricate conditions and problems which perplex and press hard on the public. Eager and assiduous as the prince was in pursuing his studies in history, economics and politics for his degree examination, he was equally zealous and diligent in gathering first-hand knowledge of the tendencies, the outlook and the aspirations of his class-mates, with whom he freely moved, while participating in the extra-mural activities of the university. The academic discipline accruing from a steady application to acquiring knowledge in the different branches of learning is in itself an invaluable asset, but the steadying and stimulating influence which the living environment of the university in all its several aspects, exercises over the young receptive mind, is far more fundamental in establishing the best traits of character. College days are a glorious time; college games and debating societies are the charter of students; all healthy-minded scholars leave the college in a flood of tender emotion, carrying with them the traditions of the old place to inspire the energies of manhood. The period of four years spent at the university must have enabled His Highness to bring back

happy recollections of his efforts in enriching his knowledge and in widening his experience through social intercourse, as it must have been undoubtedly a privilege and distinction for his fellow-students to be associated with their future ruler in a spirit of healthy competition in their daily work. In the sense of Cardinal Newman he was popularly known as gentleman prince at the university.

After taking his degree of Bachelor of Arts, His Highness was associated with Mr. D. H. Elwin, an experienced officer from Madras, in the study and investigation of the administrative affairs of the State, the problems affecting the rural population and the condition and standard of life of the common people. A programme of tours in the districts was accordingly arranged, which enabled His Highness, through the assistance of local authorities and heads of departments, to work his way through the granite of these difficult subjects. In his journeys to Japan and to Great Britain, His Highness must have enjoyed excellent opportunities of visiting public institutions, coming into intimate contact with the leaders of public life and of studying the economic, social and political organisations of these progressive countries, which, besides exercising a wholesome influence on the keen intelligence and apt capabilities of the young prince, must have produced a sympathetic open-mindedness to new ideas and ideals. The advantages of formal discipline in humanistic studies at the university have been great, the quickening influences of self-education acquired during travels must have enriched and fortified that discipline, but by far the most potent factor in moulding the thoughts and character of the young Maharaja was the spirit and influence of his illustrious *Mahatmic* uncle and the catholic temper and the genial disposition of his great father. Endowed with such excellent gifts, polished by independent impulses of different origins and by men of eminent characters, His Highness Maharaja Sri Jaya Chamaraja Wadiyar Bahadur has assumed the reigns of Government.

Mysore is on the eve of inaugurating important constitutional reforms, framed in accordance with modern notions and modern requirements, by which the popular element will have wider opportunities of co-operating with the government in its legislative and administrative functions. The policy of the new administration which His Highness will hereafter direct is admirably enunciated in the few noble and significant sentences in the message which he issued to his people on the occasion of his installation:

> "I look upon the ceremony of ascending the throne of my ancestors as a dedication of myself, my life and all I have to the service of the people of Mysore, but I am fully conscious that no effort of mine can succeed alone. I need your help and your co-operation, your confidence and your love."

The ground is well prepared. It seems to us that the present occasion is appropriate for taking stock of the progress made by Mysore in some of the important fields of administrative activity during the last fifteen years, which would enable the discerning public to visualise the potentialities of future advancement; and with this view we have invited the authorities of certain departments and important leading citizens to contribute articles which form the chief feature of this Supplement.

At the head of the administration Mysore has a Dewan whose devotion and loyalty to the Ruling Family are as spontaneous and abiding as his eagerness and enthusiasm for promoting the welfare and prosperity of the people are profound and sincere. The energy and drive which Sir Mirza Ismail has imparted to the administrative machinery have acquired for the civil service such a reputation for purity and efficiency, that it has attracted a large number of ruling princes

to Mysore to be trained in the theory and practice of administration. The value and importance of this permanent service to the State do not lie merely in its vigilance, integrity and loyalty to traditions, but arise from its receptivity to new ideas and flexibility of mind. By outlook, training and technique this machinery is competent to discharge its duties at the tempo demanded by the new constitutional changes in the administration of the State. The growing recognition of the fact that the complexity of the task of administering the State makes demands both on the government and the people, has created a new spirit of mutual understanding and co-operation, for which the recent developments in the economic and industrial spheres and the extensive organisation of medical relief afford significant evidence. Comprehensive and beneficial as these activities are, they form a prelude to the new administration for the achievement of still greater and still more enduring works of public utility for which the people are impatient, and which the Government have the necessary vision, and vigour to elaborate into the detail required.

The cardinal basis of the administration of the State has been the recognition of the fact that, if the full possibilities of government are to be achieved, if government is to grow and develop, if it is to retain vitality without acting as a barrier against a living current, the State must serve its citizens wisely within the limits of the constitutional system, and that the citizens must cheerfully and unstintingly co-operate with the efforts of government. The capacity of the citizens at once to serve the government and to be guided by it, and thus to make of government a living partnership, is dependent upon a wider, more explicit and more continuous understanding of the public of the fundamental concerns upon which both government and the life of the citizens are predicated. It is this reciprocal contribution of government and citizens that gives vitality to the State. The progress made in this department of statesmanship is due to the wisdom and sagacity of His late Highness Maharaja Sri Krishnaraja Wadiyar Bahadur, guiding the hand of his minister Sir Mirza Ismail in the administration, which is the making of modern Mysore. We stand too near to be able to gain a proper and adequate perspective of the principal achievements within recent times, but when history composes her chapters on them, she will perhaps assign to these events a place comparable with the brightest period of Abul Fazl and Todar Mal. His Highness Maharaja Sri Jaya Chamaraja Wadiyar Bahadur has come by this glittering heritage, and may Providence enable him to place the State on a pedestal of higher glory.

We shall now introduce the articles.

THE FACILITIES FOR TRAINING IN ADMINISTRATION OFFERED BY THE STATE OF MYSORE WERE UTILIZED BY THE FOLLOWING PRINCES

HIS HIGHNESS THE RAJA OF NARASINGHAR.

THE YUVARAJA OF MUDHOL.

HIS HIGHNESS THE MAHARAJA OF TRAVANCORE.

THE THAKORE SAHEB OF RAJKOT.

THE RAJA OF NAGOD.

HIS HIGHNESS THE NAWAB OF JANJIRA.

THE YUVARAJA OF DEWAS (Senior).

HIS HIGHNESS THE RAJA SAHEB OF AKALKOT.

HIS HIGHNESS THE MAHARAJA, SCINDIA OF GWALIOR (during minority before assuming powers).

THE RAJA KUMAR MANSINGH OF BANERA (Mewar State).

THE MIR OF KHAIRPUR.

PRINCE APPA SAHEB PANT OF AUNDH STATE.

THE MAHARAJA KUMAR CHANDIKESWARA SARAN SINGH DEO OF SURGUJA.

THE YUVARAJA OF JIND.

THE THAKORE SAHEB MINOR CHIEF OF KOTDA SANGANI.

THE RAJAKUMAR LAKSHMI NARAYAN BHANJI DEO OF KEONJHAR STATE.

HIS HIGHNESS THE MINOR MAHARAJA OF DHAR.

GOVERNMENT GARDENS, BANGALORE

H.M. 661 SUGARCANE, HEBBAL

M.H. II COTTON, MALLEHALLI, CLOSEPET

K. I RAGI, NELAMANGALA

INCREASE OF AGRICULTURAL PRODUCTION

THE greatest service to the country where over 85 per cent. are engaged in agriculture is the increase of agricultural production. The raiyat is the primary producer of the country's food, clothing and wealth directly from the natural resources of soil and rainfall. All manufactures and the learned occupations depend for their welfare on the efficiency of the raiyat's cultivation. Every industry has its laboratory engaged in investigation of methods of increasing the quantity, improving the quality, and reducing the cost, of production. That laboratory for the farmer is the Department of Agriculture and its utility depends upon the directness of its solutions to the farmer's problems and the speed of the transmission of these solutions to his routine of cultivation. A very brief critical review of the work of the Mysore Agricultural Department in very recent years in solving the farmer's problems will be attempted here.

The most important factor for success in solving the farmer's problems is to secure the closest correlation between fundamental research of the scientific sections, the conduct of field experiments in the Experimental Farm and demonstration in the raiyat's field. These three links in the chain are in the hands of different sets of persons with different outlook, experience and aptitude, and the secret of success of the Department lies in the proper direction of the energies of these three different sections to one common goal. Briefly stated, the fundamental problems of agriculture in Mysore are firstly how to increase production so as to reduce the deficit of raw agricultural produce in essential commodities and secondly how to increase the production of money crops for local needs and export. The greatest deficit of agricultural production in Mysore is rice and cotton of the value of nearly a crore of rupees each and pulses to the extent of nearly 40 lakhs a year. The main agricultural problem is thus how to produce more rice, more cotton, more pulses, more oil-seeds and sugar.

Out of nearly 65 lakhs of acres in Mysore under actual cultivation, perennial crops like cocoanut, arecanut, coffee and cardamoms, mango, etc., occupy less than ten per cent., and out of the balance of area nearly 80 per cent. is under dry cultivation. Dry cultivation therefore offers the largest field for increasing the wealth of the country. The crops grown in Mysore in the dry area are cereals (*ragi, jola* and other millets) comprising fifty per cent. of the total area under cultivation, pulses like *avare, togari*, horsegram and money crops like cotton, groundnut and oil-seeds. The fundamental problem for the dry-land farmer is to secure improved seeds of cereals so as to produce the country's food requirements on a smaller area than now so as to release larger area for cotton, pulses and oil-seeds. The human population of the State being about 70 lakhs, the population of ploughing cattle being only 12 lakhs, and the acreage under cultivation being 65 lakhs, the problem in dry cultivation is how to grow more per acre rather than the extension of cultivation which is limited by the population of men and cattle. In wet cultivation the problems of the farmer are how to increase the production of rice, sugarcane and irrigated cottons in the area available.

It would be interesting to examine the work of the Agricultural Department in very recent years with reference to the country's problems as set forth above. The easiest method of increasing production is the use of improved seed as it involves the least cost for securing increased production and is thus suited to the poorest man. It involves no change of the raiyat's methods of cultivation. It is the easiest to demonstrate to the raiyat as you have only to supply him the improved seed. It is also the easiest method for transmission of the benefit from raiyat to raiyat. The improvement once effected at practically no cost lasts year after year automatically without any effort. Hence the production of improved varieties of seed by plant-breeding and its distribution to the raiyat is the largest single factor contributing to increase of production. A reference will therefore be made to the contribution of the plant-breeding department to increase production per acre.

Paddy.—The deficit in the production of paddy in the State is estimated at 15 lakhs of pallas costing nearly a crore of rupees. The area under paddy is estimated at 8 lakhs of acres. It is thus clear that an increase of two pallas per acre in production would

enable the State to avoid the annual deficit of rice and prevent the drain of a crore of rupees per annum from the State. The increase of two pallas per acre in production in the course of about ten to twenty years is within the range of practical politics provided of course, that a sustained application of funds and the efforts is forthcoming. The Paddy Specialist of the Department has evolved very high yielding strains of paddy of good quality and high milling percentage. Innumerable testimony of the growers proves the possibility of producing at least two pallas more per acre. Among monsoon paddies Selection 661 fine and 699 medium evolved from G.E.B. 24 (Coimbatore Sanna) are in such extensive demand from raiyats on account of their higher yield and value that the Department is working hard to meet the enormous demand for seed. Selection 705 fine from Bangarakaddi and Selection 396 coarse, better known as Hebbal 3 months paddy, Chintamani Sanna 547 and Halubbalu 317 offer a very high yielding shorter duration paddies for summer. Several interesting crosses between Ganasale and G.E.B. 24, Nagpur Sanna and G.E.B. 24 to produce a variety with high yield, good milling percentage and non-shedding habit are in different stages of progress.

Asiatic Cottons.—The Mysore State has a black cotton soil area of over a lakh of acres for the cultivation of Sannahathi or Asiatic cottons mostly in the Chitaldrug and Mysore Districts and an unlimited area under red loamy soils for Doddahathi or American cottons. From the original Sannahathi of the Chitaldrug area, a pure-line selection S. 69 was evolved for higher yield, ginning percentage and better spinning quality. Sel. 69 has extended over nearly 20,000 acres in recent years. The late Economic Botanist, Mr. V. N. Ranganatha Rao, a very talented cotton-breeder, produced a very fine cross between Sel. 69 and *G. arboreum* known as H. 190, with a ginning percentage of 30, a spinning quality up to 30's warp-counts and an yield of nearly 8 Mysore maunds per acre. This is an excellent improvement on S. 69 securing to the grower an appreciable premium in price. This was released only three years ago for general cultivation but has already extended over about three thousand acres. By crossing H. 190 with another of his crosses C.N. 4-5 Mr. Ranganatha Rao has left behind an ideal cotton with very high ginning percentage, wilt resistance and spinning quality. By a statistical field experiment for determining the optimum distance between the rows of cotton it has been proved that the yield of cotton per acre can be increased by nearly 20 per cent. by simply reducing the distance between rows from 3' to 2'. By combining reduction in the space between rows and change of seed to H. 190 the raiyat's income per acre in the Chitaldrug cotton area is shown to be capable of being increased by nearly thirty per cent. It was also demonstrated last year in the field of a raiyat that cotton production in the T. Narasipur area can be increased 30 to 40 per cent. by substituting our H. 190 in place of local Karunganni cotton.

New World Cottons.—The black cotton soil area in the State being limited, the greatest future lies before Mysore State in the cultivation of Doddahathi or American cottons in the millions of acres in the Maidan Districts. The late Mr. Ranganatha Rao evolved an excellent cotton M.A. 2 by hybridising local Doddahathi with a Peruvian tree cotton. It is better suited to the areas in which ragi is grown than ragi itself. It is approved by the Spinning Mills at Bangalore to be a high grade medium staple cotton. It is capable of yielding upto about 600 lbs. of seed cotton per acre if sown in May in dry areas and about 1,000 lbs. per acre if sown in February or March under irrigation. The further improvement of M.A. 2 by selection and hybridisation to improve staple length and ginning percentage is in progress. With the aid of funds sanctioned by the Indian Central Cotton Committee a new long-stapled cross Co. 2 X Uganda with high ginning percentage has been evolved and is under multiplication. Promising crosses between M.A. 2 X Peruvianum and Co. 2 X Peruvianum are in several stages of progeny.

Sugarcane.—Under the Thick Cane Breeding Scheme financed by the Imperial Council of Agricultural Research new sugarcanes of very high economic value have been evolved and are under critical statistical tests and multiplication. The performance of the best of them as against the best standard canes Co. 290, Co. 419 and H.M. 320 is given in the table below.

H.M. 661 is a very bold cross between Co. 281 and Teosinte and is the most promising of new canes. It promises to yield one ton

No.	Variety	C.C.S. in tons per acre	Yield of cane in tons per acre	Brix % N. T.	Sucrose %	Glucose %	Purity %	Fibre in Cane %	C. C. S. %
1	H.M. 661	5·23	40·2	20·50	19·20	0·38	93·66	17·60	13·02
2	,, 657	5·09	45·5	19·30	17·30	0·50	89·64	19·00	11·18
3	,, 656	4·69	37·0	20·50	18·80	0·35	91·71	17·05	12·08
4	,, 651	4·66	39·1	20·90	18·90	0·30	90·43	21·00	11·93
5	,, 658	4·52	39·7	19·60	17·30	0·73	88·26	17·09	11·38
6	C.O. 290	4·37	35·3	18·90	17·00	9·62	89·95	12·72	12·03
7	,, 419	4·35	33·2	20·60	18·65	0·59	90·53	13·52	13·10
8	H.M. 659	4·34	36·1	19·90	17·50	0·62	87·94	13·80	12·02
9	,, 654	4·27	36·1	20·60	18·00	0·83	87·38	16·70	11·83
10	,, 320	4·26	32·3	20·00	18·44	0·48	92·25	13·10	13·19

more sugar per acre than the present standard canes. It is a very vigorous cane which has been found to grow well under varying conditions of soil and irrigation.

Ragi.—Several new strains of ragi were tried during the last three years. Among the early varieties, that is, with a duration of 3 months from the date of transplantation, K_1 ragi of Mysore and E.C. 3735 of Madras have been found to be the best. In the varieties of medium duration, that is, about 4 months, E.S. 4, E.S. 11 of Mysore and E.C. 593 of Madras have been found to be the best. Among the late varieties, that is, with a duration of 5 months, H. 22, Dharani ragi and Konanakombu have been found to be the best. All these are far superior to the local ragies. Of all these E.S. 4 was found to give the highest yield of 10¾ pallas of ragi per acre when tried by one of the most progressive raiyats near Bangalore. Limitation of space in this article does not permit of reference to the selection work done in the other crops but the most interesting work has been done on groundnuts where a very wide range of crosses from those which yield the highest quantity of nut to those which yield the highest quantity of green leaves, have been evolved. An interesting variety of groundnut which grows to a height of 2 ft. is promising for fodder and green manure.

A very large number of manurial experiments on different crops were laid out in statistical pots with the object of reducing the cost of production per acre. The raiyats who are superficial have the impression that manuring adds to the cost of cultivation. This is only literally true as judicious manuring reduces the cost of production per ton of the crop. The manurial dose adopted for sugarcane in the Irwin Canal Farm yields 10 times more cane than in the unmanured plot. Seeing that the cost of cultivation other than manuring is the same between the two, the advantages of judicious manuring are only too obvious. New manurial formulæ have been fixed after a series of statistical trials to secure yield and quality of cigarette tobacco and several other crops. The manurial formula adopted for paddy has in many cases increased the yield by 25 per cent. The manurial formulæ for different crops have been compiled and published recently in a bulletin.

Among successful cultural experiments the most important is the intercultivation of ragi and cotton which was demonstrated last year for the first time in the Rural Welfare Centre, Closepet and which has been adopted over hundreds of acres in that Taluk. This new cultural practice has a great future as increasing the raiyat's income from dry land and increasing the production of cotton in the State. This practice is capable of extension over millions of acres.

Live-Stock.—The improvement of live-stock is no less important than improved strains of crops or application of manures as soil tillage is the most important factor

in the success of cultivation. Cattle rearing is the most important subsidiary industry of the raiyat as Mysore supplies ploughing cattle to the adjoining districts of British India. The fiery Amrit Mahal wild breed of cattle originally reared for military transport is being domesticated to serve agricultural purposes. In addition to the Ajjampur Cattle Breeding Station for 1,000 cattle the Hunsur Cattle Breeding Station was started last year for 500 cattle. The supercession of the ranching system by the farming system has very greatly improved the condition and growth of the cattle. A very large number of bull-calves are sold for breeding purposes at concession rates to cattle-breeders.

Sheep-breeding is an important subsidiary industry essential to agriculture for the sake of the manure. There are nearly three million sheep in Mysore but their economic value at present is only in the value of the carcase and manure. The wool-yield is barely ½ a pound per head per annum valued at 4 annas a pound. By cross-breeding with Merino the wool yield is raised to 3 lbs. per annum valued at 12 annas a lb. To accelearte cross-breeding a pure-bred Merino flock has been imported from South Africa. Orders have also been placed for Corriedale sheep. Sheep Breeders' Associations are working in Kolar and Mysore and a new one will soon start work at Channarayapatna. The Yellachihalli Sheep Farm for indigenous sheep and the Ajjampur Sheep Farm for cross-breds supply stud rams to raiyats.

Poultry-farming is a very lucrative subsidiary occupation. White Leghorn hens lay an average of nearly 200 'A' grade eggs a year valued at 12 annas a dozen while their cost of maintenance is only Rs. 3 per annum. Rhode Island Reds are a dual purpose breed. A hen of this breed lays in the average about 170 to 180 'A' grade eggs a year valued at 12 annas a dozen while the cost of maintenance is only about Rs. 4 per annum. For demonstration and supply of hatchable eggs, chickens and table-eggs, ten poultry farms have been opened in several parts of the State.

Bee-keeping.—Bee-keeping is a very useful subsidiary industry which involves no cost whatever except providing hives for the bees. During recent years six demonstration centres with several bee-colonies in each were being conducted and propagandists are demonstrating improved methods of bee-keeping. One tangible result of this work is the starting of a Bee-keepers' Co-operative Society at Saklespur with 500 improved bee-hives in addition to a large number of pot-hives which are gradually being replaced by box-hives. Within six months of its starting it has collected 7,000 lbs. of honey from its members and clients.

Demonstration.—The most important work of the Department during the last three years is the development of demonstration work, that is, the extension of the benefits of research to the raiyat's field. Nearly 4,000 demonstration plots are laid annually in raiyat's holdings to convince him that even with his present methods of cultivation higher yields of produce can be obtained by mere change of seed to improved varieties or by altering the manurial dose. The net result has been an enormous increase in the demand for improved varieties of seed. The allotment for purchase and distribution of seed four years ago was Rs. 10,000. In three years, that is 1939–40, five times that allotment was found inadequate. The quantity of improved seeds of paddy and cotton distributed last year is nearly 5 times the quantity distributed four years ago. Here is unimpeachable evidence of the contribution of the Department's work to the increase of agricultural production in the State and an unimpeachable testimony of the raiyat to the usefulness of the service rendered to him by the Department. In view of the difficulty to meet the enormous demand for improved seed, seed farms are being organised locally all over the State. If proof of the pudding is in the eating, proof of the usefulness of the Department is in the thirst for improved seed.

T. G. RAMA IYER.

THE CO-OPERATIVE MOVEMENT IN MYSORE

THE Co-operative Movement was introduced in the Mysore State by the Government of Mysore in 1905 after the Mysore Co-operative Societies' Act was placed on the statute book of the State. The object of the government was to assist the formation of co-operative societies which had as their aim the promotion of the economic interests of their members and the inculcation of the habits of thrift and self-help among agriculturists, artizans and persons of limited means. The first Co-operative Society registered under the Mysore Act was the Bangalore City Co-operative Society, a combined stores and credit society. The Act was amended in 1918 mainly on the lines of the Government of India Act of 1912, and more recently in 1929 to facilitate the formation of Land-mortgage Banks; in 1933 for making provision of a better administration of the societies and for exercising an effective control over their working; and again in 1935 for further facilitating the working of the Land-mortgage Banks and Societies.

General Progress.—The progress of the movement in the State may be divided into four distinct stages. The first stage covers the years 1905–12 when the ground was prepared by continuous propaganda and a few societies were formed here and there. At the end of 1911 there were 111 societies, with a membership of 9,043 and a total working capital of Rs. 3,71,194. The second stage which may be said to have continued up to the end of 1920–21, witnessed the establishment of 1,500 societies, with a membership of 92,121 and a working capital of Rs. 78·19 lakhs. As the movement had to face knotty problems of a varied character requiring expert advice and solution, government were pleased to appoint a committee of enquiry under the chairmanship of the late Sir Lalubhai Samaldas Mehta of Bombay. The Committee's Report was published in 1923. The third stage of progress was reached and a policy of consolidation of the movement coupled with cautious expansion was pursued for another five years, i.e., till the end of 1925 when there were 1,474 societies with a membership of 91,602 and a working capital of Rs. 92·22 lakhs. By this time the after effects of the 1914–18 War on the world economic conditions were markedly seen. Commodity prices soared high and land values mounted up and the agriculturists were in a prosperous condition indeed. A policy of further expansion coupled with the establishment of land-mortgage banks was pursued and by 1930–31 there were 2,213 societies, with a membership of 1·38 lakhs and a working capital of Rs. 1·89 crores. With the appearance of the economic depression in 1930–31, the fourth stage of the movement was reached and a policy of consolidation and rectification coupled with the weeding out of societies having no life in them was pursued. A Committee of Enquiry was appointed in 1935 with Diwan Bahadur Rajadharmapravina Mr. K. S. Chandrasekhara Iyer, B.A., B.L., Retired Chief Justice of the High Court of Mysore. At present there are 1,895 societies with a membership of 1·4 lakhs and a total working capital of Rs. 2·7 crores.

The largest number of societies are agricultural credit societies. They number 1,436 with a membership of 64,000 and a working capital of Rs. 58·78 lakhs. Their main function is to finance the agriculturists for short-term and intermediate requirements with the help of the Apex Bank. The Land-mortgage Bank and societies are meant for financing the agriculturists for the redemption of their prior debts. The Mysore Central Co-operative Land-mortgage Bank was started in 1929 and it finances the members of primary land-mortgage societies through them. The Bank has at present a membership of 207 (inclusive of 39 land-mortgage societies) and a paid-up share capital of Rs. 1,09,000. The Bank's working capital is raised by the floatation of debentures guaranteed by the Government of Mysore both for principal and interest. The amount of debenture capital raised up to date is Rs. 11·5 lakhs. It has sanctioned loans to the extent of Rs. 14·06 lakhs in 1,215 cases of which 12·61 lakhs have been disbursed. The Land-mortgage Societies which are at present operating in 40 taluks, 4 sub-taluks and portion of three taluks have a membership of 5,928 and a share capital of Rs. 1,25,700. The Land-mortgage Scheme is being gradually extended and it is expected that ere long there will be a net work of

land-mortgage societies operating throughout the State.

Non-credit Agricultural Societies.—With a view to remedying the main defect of the movement which is more or less one-sided now, credit preponderating and to make it subserve the needs of the agriculturists more largely, the attention of the Department has been diverted to the development of non-credit activities. The Plantain Growers' Marketing Society organised at Hiriyur has done good work and promises to do better. The Ganjam Figs Marketing Society has enrolled 69 members and during the year it has been able to sell 80,697 fruits co-operatively. The Malnad Fruits Marketing Society has sold over 4 lakhs of oranges during the year. The Bee-keepers' Society at Saklespur has enrolled 39 members and collected 6,000 lbs. of honey and is attempting to solve the question of a good market for the honey. It has indirectly helped the development of apiculture in the Taluks of Saklespur and Belur. The Malnad Areca Marketing Co-operative Society has enrolled 662 members and handled 26,000 maunds of areca during the year. Spraying materials worth Rs. 12,000 have been advanced by the Agricultural Department to the members of this Society. The Nuggehalli Cocoanuts Marketing Society has just commenced its operations. The work of distributing good cotton seed has been continued in the credit societies in the Chitaldrug District and the Maradihalli Co-operative Society is leading in this direction. This society handled during the year 26,855 maunds of cotton. One Adkarnataka Society collected 150 pallas of neem seeds for sale co-operatively. It also arranged for training being given to its members in poultry farming, tanning, button manufacturing and mat weaving and the question of introducing such work in a few more societies is engaging attention. An egg marketing society has recently been formed at Dodballapur. The work relating to the stocking and supply of kole-roga sprayers and materials has been tacked on to a few rural societies in the Koppa and Sagar Taluks and Sringeri Jahagir Taluk. The Potato Growers' Marketing Society formed at Ramagondanhalli in the Bangalore Taluk is progressing and the co-operative sale of ragi, paddy, jaggery, eggs and other crops of commercial importance is receiving attention. Organisation of multi-purpose societies and the tacking on of multiple activities to the existing credit societies, wherever conditions are favourable and proper personnel to manage the concerns efficiently are available, is being pursued. These measures, it is trusted, will create a better atmosphere for the formation of village banks catering to all the needs of the villagers, envisaged by the authorities of the Reserve Bank of India.

Urban Co-operative Banks and Societies.—Societies situated in the Cities of Bangalore, Mysore and Kolar Gold Fields, the District and Taluk Head-quarters places are classed as urban. Though the Co-operative Movement was introduced primarily for the benefit of the agricultural classes, the first society registered under the Mysore Co-operative Societies' Act is the Bangalore City Co-operative Society, Ltd., which is a combined banking and consumers' society. The fairly successful working of these urban institutions is mainly due to the availability of the requisite human material to run them and also to the fact that the principles of co-operation and banking are easily understood by the town-dwellers, being generally more literate than their brethren, living in the rural areas. The membership is largely drawn from the salary earners, the followers of the professions such as law and medicine, merchants, contractors and labourers. While a large percentage of members of these societies consists of the servants of Government and the Municipalities, salary earners' societies for the benefit of the employees of particular public offices, commercial concerns and mills are also in existence side by side. It has to be admitted that urban life is characterised by lack of mutual knowledge, diversity of occupation, a more or less developed business instinct and egoistic tendencies, which are not quite conducive to co-operative consciousness. But though the urban societies are lacking in co-operative character in that there could be no mutual knowledge and no mutual control, they have fared better than their rural counterparts and have taken their rightful place in the economic life of the town-dwellers. There are 360 urban societies in the Mysore State with a membership of over 70,000 and a total working capital of Rs. 1·30 crores which is nearly half the aggregate working capital of all classes of societies in the State.

Judged by their financial strength—they do not stand in need of finances from the

Apex Bank or Government—these urban banks have done very well indeed. They had, on 30th June 1939, 70,000 members and a total working capital of Rs. 1·30 crores. The foremost object of Urban Banks and Societies is the development of thrift among their members and it is indeed an achievement that these institutions have a paid-up share capital of Rs. 34·50 lakhs and hold deposits aggregating to Rs. 68 lakhs. While it is no doubt true that the bulk of the deposits has come from non-members or from the well-to-do among the members, and the average man's deposits are few, that they have been able to tap the local capital and make it available for being advanced to the members at reasonable rates of interest and easy terms of repayment, is in itself a remarkable achievement. Along with the development of thrift, though to a small degree, these institutions have created a sort of banking consciousness among the people. The use of cheques and the opening of current and drawing accounts in many societies and the transfer of funds from one place to another by means of such cheques have been helpful to trade.

Consumers' Movement.—Besides the credit movement, the urban areas have a large number of full-fledged consumers' societies to serve their members' needs in the sphere of the supply of the necessaries of life. There are 68 such institutions with a membership of over 16,000, the annual sales amounting to nearly Rs. 15 lakhs. These societies are combined credit and stores societies and represent a distinct feature of the Mysore Movement. Sales are for cash as well as on credit. Prices are not subject to the fluctuations of the market. These may appear very strange to the orthodox co-operators who pin their faith to the principles laid down by the Rochdale pioneers. But the fact that the societies have not suffered by the rapid fall in commodity prices and were able to weather the storm successfully during the economic depression, indicates that the slight departure from the orthodox principles may not after all be a stumbling block in the working of the consumers' societies.

One of the most important functions of the movement is the cheapening of the capital to such a degree as to make it available to the poorest among the society on terms which are within his resources to fulfil. That the general rate of interest on loans has been brought down so low as 6 per cent. is an achievement of which the co-operators may well feel proud. But the urban population of the State is over 10 lakhs and the number of persons brought within the co-operative fold is only 70,600, which on the assumption that a member represents a family of five persons indicates that about 35 per cent. of the urban population is served by the movement. Even after an allowance is made for multiple membership, it can safely be put down that 25 per cent. of the town-dwellers enjoy the benefits of co-operation. When it is remembered that the money-lender particularly the Pathan, the Marwari and the Multani are, in spite of the existence of so many banks—joint stock as well as co-operative—still thriving and having a prosperous trade in their profession, the vast field that has yet to be covered by the Co-operative Movement becomes apparent.

The major urban societies are housed in their own spacious buildings; they maintain Free Reading Rooms for the benefit of their members and the general public; they contribute liberally out of their annual profits towards charitable objects and in aid of charitable institutions. A few have installed radio sets for the benefit of the residents of their localities.

Thanks to the early workers in the field, the movement has taken a firm root in the urban areas and there is great scope for its further development. An urban bank or a stores society necessarily implies large-scale operations and comparative economies in overhead charges. The smaller the working capital the more inefficient and ill-paid will be the staff and the more unsatisfactory will be the management. It seems therefore desirable that the smaller units in the urban areas amalgamate themselves with each other so that one efficient and well-managed institution may serve the needs of a compact Municipal Division or area, without at the same time becoming too unwieldy for efficient services to its members.

Other forms of Co-operation.—The importance of the co-operative movement among the several agencies for rural uplift has been receiving more and more recognition and full use is made of the movement for the resuscitation and reconstruction of rural life. Societies embracing all the phases

of village life are slowly coming into existence. The societies formed for the exclusive benefit of the weavers, gudigars (sandalwood carvers) and the depressed classes are receiving special help from Government.

Co-operative Propaganda and Education.—The need for co-operative education has been realised and classes are held for the secretaries and panchayatdars of societies. Co-operative propaganda is carried on even in the distant villages of the State by means of lectures. Lectures on co-operation by the officers of the Department are a common feature of the District and Taluk Conferences. With a view to inculcate the spirit of co-operation among the student population,—who are the future citizens of the State,—students' co-operative societies are organised in schools and colleges with the co-operation of the Educational authorities. *The Mysore Co-operative Journal*, conducted by the Mysore Co-operative Institute, carries the gospel of co-operation to the nooks and corners of the State.

M. ABDUL HUKH.

EDUCATIONAL PROGRESS IN MYSORE

THE attempt to review the progress of education in the State of Mysore during the past 15 years in a short note is not an easy task, and the following paragraphs can only hope to pick out for comment a few isolated features of the work of the Department during these years.

The total expenditure on education of all kinds in the State of Mysore (including the cost of the University of Mysore) has risen during the period under review from roughly Rs. 60,00,000 to over Rs. 70,00,000 per year. By comparison with the neighbouring provinces of Madras and Bombay or with the neighbouring States of Cochin and Travancore, it can be seen that the people of the State of Mysore have far more done for them by their Government in the matter of education than is general elsewhere. From the figures for the year 1938–39 it can be seen that practically 78% of the total cost of all expenditure in the State was met from State Funds. Fees account for only 9% of what is left and Local and Municipal Funds roughly for the remainder. It can be said with truth that there are few other places in India, if any, where Government bear so large a part of the cost of education, and where aided enterprise bears so small a portion. The State of Mysore has just cause to be grateful for the educational efforts of a number of Missionary Agencies, some of which have been working for over a century in the State, but at the same time it has to be said that the habit of self-help requires to be much more strongly developed. There is obviously a definite limit to the amount that can ultimately be found for education from State Funds, and in any extensive scheme of future expansion aided agencies will have to play a larger part than they have done in the past.

Schools fall into two main categories —Primary and Secondary—and in Mysore the latter category is subdivided into two classes of schools, *viz.*, Middle Schools and High Schools.

Nine years ago Elementary Education was handed over to local bodies, and it was hoped that in consequence there would be a marked expansion in the number and quality of primary schools. The local bodies were empowered to levy an education cess to augment their financial resources, and, under the Act, Government were bound to provide from State Funds their share of any such expansion. The experience of nearly 10 years has, however, proved a disappointment to the high hopes with which elementary education was transferred to these local bodies. The expected expansion has not taken place at all, and it is not either an exaggeration or unkind to say that the rate of progress is probably smaller than it would have been, had Government continued to control these schools. A Committee was in consequence recently appointed to enquire into the whole matter of elementary education, and this Committee has recommended to Government that in the best interests of elementary education Government should resume control from the local bodies. The necessary legislation in the matter is expected to be undertaken very shortly, and it is hoped that an expansion of 1,000 primary schools in the next four years will thereafter be undertaken by Government.

Middle School Education is free in Mysore State—a state of affairs which does not seem to exist anywhere else in India. Fees were formerly charged in Middle Schools in Mysore, but about 20 years ago they were abolished. This was done to encourage people, particularly those in rural parts, to send their children to Middle Schools. The gift of free education at this stage has undoubtedly been appreciated, and the response is now almost an embarrassment to Government. The present number of Middle Schools is over 350, and there are over 50,000 pupils in them. The demand for this class of school is incessant, and far outstrips any possibilities of satisfying it fully. There are demands for new Middle Schools from nearly a hundred different places in the State, and the majority of these places have no hope of having their request granted under present financial conditions. The question of the re-imposition of fees in Middle Schools is under consideration.

There is not quite the same demand for new High Schools as there is for Middle Schools, because pupils have to pay fees in

High Schools, and have also to pass the Middle School Examination before they are eligible for admittance to a High School. There has, however, been a steady increase both in the number of High Schools and in the number of pupils attending them during the past 15 years. High School education was re-organized three years ago, and special courses were started of an industrial, commercial and domestic nature, intended for pupils who do not wish to proceed to the University. It is too early to pronounce definitely upon the success of the scheme, but the experience of the first three years goes to show that there is very little appreciation among the general public in Mysore of any High School course which does not admit a pupil to the Intermediate Classes in the University. Public speakers of all kinds are accustomed in these days to refer in somewhat disparaging terms to what they are pleased to call the inadequacy of so-called "literary" education. If the experience of the attempts on the part of this State to provide alternative vocational courses is any indication, it can only be said that pupils and parents alike show little or no appreciation of any such courses, and desire nothing except a school-leaving certificate which will admit to the University.

The Mysore State was one of the pioneers in India in the introduction of Kannada as the medium of instruction in non-language subjects in High Schools. Upon this scheme also it is perhaps too early to pronounce judgment. There are far more pupils desiring admittance into the English sections in High Schools than there are places available. This question appears to be one in which people "want to eat their cake and have it". Parents do not wish their children to be weaker in English, and yet at the same time they want the advantages accruing from the teaching of subjects like History and Geography in the vernacular. Public opinion has not yet come to realise that this is one of the questions in which it is not possible "to have it both ways". In Mysore State, at any rate, Head Masters of High Schools are unable to satisfy the demand of those who wish their children to be admitted to the English sections as distinct from the Kannada sections in High Schools.

The medical inspection of school children has received considerable attention during the period under review, and recently Government have appointed a Chief Medical Inspector of Schools to co-ordinate and supervise this work. Medical inspectiton was originally confined to the children in the cities of Bangalore and Mysore, but in the last few years there has been a great expansion of medical inspection in other municipalities, which have shown a great appreciation of the value of this work, and have been willing to contribute from Municipal funds for the purpose. This year medical inspection is being conducted in over 70 municipalities—a number that is double that of last year. As more funds become available, it is hoped to provide increased facilities for follow-up treatment of pupils whose defects are noted at medical inspections.

Side by side with medical inspection has gone the provision in many places of midday meals for poor pupils, who come from a distance or who cannot get such facilities in their homes close-by. This is a matter in which public generosity has a wide field open to it—particularly in rural areas. Small children, who have to walk several miles to the nearest school, cannot be expected to get the maximum benefit from their afternoon lessons, unless they can get a meal of some kind at the lunch interval. In some places local people have taken up this work, but much more could be done.

E. G. McALPINE.

FORESTRY IN MYSORE

A NEW phase in the development of the State Forests was opened when in 1926 Government launched upon its policy of planned industrialisation. It was inevitable that Mysore forests should form an integral part of any such scheme. The consequence was not only that new needs had to be satisfied but better and cheaper methods had to be introduced for meeting the old demands. The rôle of forests in the economy of Mysore tended to be more important than had been before thought possible. The publication of "Some Problems of the Mysore Forest Department" in 1928 (followed a little later by "Some more Problems of the Mysore Forest Department") marked this change in outlook and perspective.

It is not easy to assess in terms of figures the progress achieved since then. In forestry there is no single yard stick which adequately measures such development. The more so in the case of Mysore where the largest single item of forest revenue, *viz.*, "Sandalwood" receipts fluctuate violently year by year, the erratic price changes produced by a number of world factors. For this reason, the net receipts from sandalwood which reached a peak figure of Rs. 24·62 lakhs in 1928–29, fell down to only Rs. 7·62 lakhs in 1938–39. The same is true of Tangadi (*Cassia auriculata*) and Kakke (*Cassia fistula*) which are used as tanning barks, the receipts from which were Rs. 7·32 lakhs in 1927–29 dwindling down to Rs. 1·32 lakhs in 1935–37. Therefore the gross forest revenue of Mysore has varied during the period 1926–40 between about 25 to some 46 lakhs of rupees. Such fluctuations are inevitable to the producers of primary raw materials. A much better index to the efficiency in the development of Mysore forests is provided by the following table, wherein are given some significant comparative statistics relating to Mysore and some of the leading Indian provinces. The figures relate to 1937–38, the latest financial year for which the information is available.

Name of Province	Percentage of surplus to Revenue	Percentage of expenditure to Revenue	Percentage of expenditure on demarcation, improvement and extension of forests compared to total expenditure
United Provinces	45	36	8·80
Central Provinces	27	40	4·2
Madras ..	15·68	58	3·3
Bombay .	37	48	3·0
Mysore ..	54	20	8·1

These results have been made possible by the systematic development over a wide front, including transport and utilisation, while at the same time particular care has been taken that this development has not been at the expense of the capital; in other words, sound sylvicultural tenets are not being sacrificed merely to reap transient monetary benefits.

Forest transport,—the essential preliminary to any forest development,—has progressed. The tramway routes in the Bhadravati forests have made it possible to make use of forest crops previously allowed to rot away. The same is true of the Agumbe Ghat forests. The success attained here has prompted a consideration of measures similarly to open the valuable Manjarabad Ghat forests in the Hassan District. One of the prime considerations in opening the Arasalu–Sagar Railway line was the transport it would provide for forest produce. The same is true of the bridge proposed to be constructed over the Suvarnavathi near Chamarajanagar, for this would open out the hundred square miles of the Chamarajanagar State Forest to the timber market at Mysore.

Mysore may well claim the credit for having pioneered the use of Balagi (*Poecilloneuron indicum*) for the use of electric transmission poles. The difficulties involved in felling these giants of the forest, in transporting them for nearly 65 miles over winding Ghat roads not designed for such traffic, were formidable; added to this were the conservatism and prejudice which had to be overcome before the poles could prove a commercial success. The same story was repeated with Dhuma (*Dipterocarpus indicus*);

it was practically an unknown timber some twelve years ago; to-day it provides tens of thousands of sleepers for railways in and out of Mysore.

The utilisation of these Ghat woods was made possible by the adoption of modern wood preservation methods. A plant for this purpose was established at Bhadravati in 1928. It was a significant event for the utilisation of the virgin Ghat timbers. Even from the purely financial point of view, the plant has already paid itself out, and is earning substantial profits. Its annual gross receipts exceed two lakhs of rupees.

A new industry was born in Mysore when in 1936 the Mysore Paper Mills were established, an industry which consumes annually some 15,000 tons of bamboos from Mysore forests. The Mysore Match Factory is the latest addition to this growing list of industries dependent on Mysore forests for their raw material. Mention may also be made of the improvisation of the departmental saw mills at Shimoga and the addition of up-to-date Seasoning Kilns—facilities which have enabled a bid to be made for the substantial market in packing shooks and cases. "Mysore makes many products, but only the best of each." It is a proud slogan. And Mysore forests have contributed their own mite to some of these products.

In the realm of minor forest products, the extension of the cultivation of lac deserves mention. The Mysore Paint and Lac Works have been extended and consume Mysore lac for manufacturing a wide variety of polishes, paints, varnishes and other lac products. In 1938–39 nearly 1,300 maunds of lac were supplied to the factory. Increasing efforts are being made to supply the local requirements of medicinal drugs. Mysore forests are rich in these herbs. Some of these are recognised by the standard pharmacopœias while a large number are popular remedies in the indigenous systems of medicine. A collection of these herbs, their identification and nomenclature have received attention as a necessary prelude to their more systematic exploitation. Some 300 of these authentic specimens have been listed. Government has also appointed last year an authoritative Committee to go into the question. Attempts are also under way to cover Mysore's requirements of quinine by locally grown Cinchona. One hesitates to mention Sandalwood when dealing with minor forest products but, thanks to careful organisation and propaganda, the retail sale of Sandalwood all over India is on the increase during the last few years, and receipts from this source have reached the 2 lakh mark.

It has to be reminded that forest utilisation is but a part—although admittedly a very important part—of forestry. The afforestation and conservation of our resources are a vital part of the programme. The exploitation of forests,—especially round about Bhadravati, is followed up by methodical regeneration operations. This is proceeding in accordance with an elaborately drawn up plan and careful measurements and surveys show that the regeneration is in close conformity with the calculations on which current practices are based. It is also interesting to record that the rate at which teak plantations are being raised in Mysore offsets three to four times the mature teak crop that is being harvested. During the last decade teak plantations are being formed at the average rate of 500 acres per year and in the peak year—1934—over 1,100 acres were stocked with Teak. From figures gathered, it is revealed that the satisfactory compensatory regeneration of teak in Mysore has reached a level which compares favourably with any other province in India. The total area of teak plantations in the State which was 5·62 thousand acres in 1926 has now been increased to more than double this figure, being 12·64 thousand acres in 1939. This policy of steady afforestation on conservative lines has received a further fillip by the growing demand for domestic fuel in the urban areas. In this connection, the technique of raising Casuarina is almost perfected, and a new method for other fuel crops by "patch sowing" is meeting with considerable success. An outstanding example of afforestation work during the period under review is provided by the Hulikere plantations in the Irwin Canal area. In the development of Mysore forests, therefore, posterity is not being mortgaged. On the other hand, there have been perceptible additions to the capital.

Mention has already been made of the important accessories which forests provide to an agricultural community. These are chiefly grazing, small timber, fuel, manure and minor forest produce. With respect to every one of these, regulations have been, within the last fourteen years, liberalised in

favour of the ryot. And in times of distress like drought, epidemics, fire, etc., the forests resources are freely thrown open to the ryot. Apart from this, the forests are making their own contribution to the rural reconstruction schemes in the State by the raising and supply of suitable seedlings for avenues, village groves and gardens. It is not easy exactly to assess the monetary equivalent of these concessions and services. To take but one example, in addition to grazing facilities enjoyed by the ryot on payment of the usual (but nominal) rates, nearly 400,000 heads of cattle were allowed in 1938–39 to resort to the State forests for grazing either free or at concession rates.

The necessary prelude to the methodical exploitation of any forest is its survey and preparation of working plan. Steady progress has been kept up. Thus while in the year 1925–26, 1,106 sq. miles had been provided with sanctioned working plans, the area had increased by 786 sq. miles to 1,892 sq. miles in 1939. Besides, some 500 sq. miles of forest have been brought under "provisional plans". The Department also maintains nearly 400 miles of forest roads and paths. The feasibility of bettering forest transport by the provision of treated timber bridges has been taken up, and it is hoped to have a few of them fabricated soon; they would, in addition, have a demonstration value.

In the midst of so crowded a programme, measures for the conservation of Mysore fauna have not been overlooked. A special authoritative committee was appointed in 1937 and based upon their comprehensive report, Government have recently passed orders designed to give the necessary protection to the cultivator from the ravages of wild animals, the desirable amenities to the *bona fide* sportsman, and at the same time sternly to put down poaching and other illicit practices. The improvement and extension of Game sanctuaries have been taken up. The Karapur and Bandipur Kheddah and Game camps are world-famous; the strict protection afforded in the sanctuary of the Chamarajanagar forests is already yielding results, and tigers, which had become almost extinct in this region, are moving towards their old haunts. In collaboration with the Bombay Natural History Society, a survey of the birds in the State has been conducted, and this year a bird sanctuary was formed on three islands in the Cauvery River near Seringapatam. Measures have also been planned to make a survey of fish, and its preservation to provide a regular supply for consumption.

Forestry education has always presented a problem in India. During the period under review, an innovation was made in the training of recruits to the Mysore Forest Service. A number of selected Science graduates, after preliminary training in the Mysore forests, were sent abroad to reputed centres of Forest research, so that in the Service to-day are to be found men trained in Indian, English, Continental and American schools, lending a catholicity of outlook to the Service as a whole. Just this year, a Forest School has been opened for the training of men to the executive cadres.

In establishing the Forest Research Laboratory in 1938, Mysore has taken an important step, being the first province or State in India to have set up such a laboratory. The famous Forest Research Institute, Dehra Dun, maintained by the Central Government, was till now the only Institution in India devoted to Forestry research. Although the beginning in Mysore is small, it is pregnant with possibilities. And it is pleasing to record that the entire investment for the Forest Research Laboratory was provided from out of the profits of the Wood Preservation Plant. The *raison d'être* for the Research Laboratory was summed up as follows by the Dewan in his address to the Mysore Assembly in September 1938:—"Mysore is fortunate in its forests which, apart from their great value to the ryot and their importance to rural economy, have contributed large sums to the State Exchequer. A fuller and more economic utilisation of our forest resources has engaged the attention of the Government, and, as I said in my speech at the last session of this Assembly, they have sanctioned the proposal of the Chief Conservator of Forests to establish a Forest Research and Experimental Station at Bangalore. The Laboratories of the Institute, though small, are equipped on the most modern lines and provision has been made for a nursery and other adjuncts of an up-to-date forest research centre. ... Our very large resources in soft woods have remained practically untapped, mainly on account of the lack of adequate knowledge about their properties.

Forest soils, the suitability of different species to each type of soil and soil erosion are problems which have not so far received the attention they deserve. The problem presented by the Spike disease of Sandal still remains to be solved. The better utilisation of even the minor forest products like tupra leaves, charcoal, insecticidal plants, tanning barks, etc., all mean more revenue to the Department. These, then, are some of the more important problems which will be tackled by the Institute." Within the two years of its existence, the Laboratory has done a considerable amount of the spade-work and has already paved the way for the utilisation of some practically unknown soft timber and successfully to introduce a couple of exotics of economic value.

So much for the retrospect of the last fourteen years—years full of plans and efforts and achievement. We may briefly indicate the developments in the immediate future. There is likely to be larger increases in the forest areas. After all Mysore has barely 15 per cent. of her total area under forests. Even the highly industrialised countries in Europe and Japan, have much larger proportions of their total areas afforested. And when the public realises the full significance to their well-being and even to their very existence, it is to be hoped it would co-operate wholeheartedly in extension and conservation of the forests. In the realm of utilisation, junglewoods are slowly but inexorably coming to their own, challenging the supremacy of the conventional timbers. One can already perceive a bias in favour of raising non-teak timber crops on a short-term rotation, the harvested timber forming a raw material for chemical processing industries instead of forming mere structural construction; tool handles are on the way; plywood and laminated wood just round the corner. The use of charcoal as motive power for transport has already been tried in the State and in the absence of indigenous coal and petrol supplies, it is a safe prophecy that the rôle of forests in the State economy would be even more pronounced. It might also prove that Minor Forest Products are after all not so minor at all. Lastly, let it be remembered that forests are a crop, therefore renewable and therefore inexhaustible. The financial returns from forests thus represent an important item of non-tax revenue whose total capitalised value is of very great importance to the State.

The experience of these fourteen years and the plans chalked out for the future entitle one, therefore, not to complacency, but to quiet optimism. In the meanwhile there is the satisfaction of having grown two blades of grass where one grew before, and of having made the one blade that is harvested go much further in use than it used to.

ABDUL JABBAR.

MINERAL DEVELOPMENT IN MYSORE

MYSORE has been contributing annually, in recent years, some 12 to 15 per cent. of the total value of mineral output in India, providing employment for more than 35,000 persons in several mining and mineral industries. The prominent position which the State now occupies in its mineral production is due to the great progress which it has made in mineral prospecting and mining operations during the period of the long regime of the late Maharaja of Mysore.

Starting work soon after its inception at the end of 1894, the Geological Department discovered, within a few years, several deposits of economic minerals and numerous old workings for gold during the course of the survey. There arose at once a rush for the exploitation of the minerals in the State, and till 1915, the prospecting and mining of these were mainly confined to private enterprise. The Department being actively engaged in conducting the systematic geological survey, was functioning, more or less, as an administrative and advisory organisation, in matters of mining and prospecting, —issuing licenses and leases and enforcing its prescribed rules and regulations in the conduct of mining operations. During this period, several of the old workings for gold were opened out by deep underground prospecting, but none of the licensees succeeded in establishing any paying mines. Some of the minerals such as the chrome and manganese ores, magnesite, mica, asbestos, etc., which could be sold readily—without any further treatment—were mined on a fairly large scale by shallow open quarrying and the minerals were being won solely for export purposes. Under these conditions, there arose a danger of the richest and most easily accessible of such mineral deposits getting rapidly depleted leaving the poorer ones as unprofitable and useless.

By 1915, the preliminary geological survey of the State was completed, and it was considered desirable that the Department should thereafter bestow greater attention on detailed mineral surveys and large-scale prospecting and development of mineral deposits of economic value. At this time, the scheme for setting up an iron smelting industry in the State being under consideration of Government, the Department started its large-scale prospecting operations on the iron ore deposits near Kemmangundi, in the Bababudan hills, to prove the extent and grade of ores for smelting purposes. Extensive prospecting operations were also carried out on some of the limestone deposits to locate some suitable flux. As a result of these investigations, the deposits then located, tested and developed were taken up for open cast mining, on a large scale, by the Mysore Iron and Steel Works, which started the smelting operations in 1922.

In addition, the Department started detailed investigations in several parts of the State to study the available resources of various other minerals—both metallic and non-metallic. Private enterprise in mining and prospecting was, as before, confined mostly to minerals which could be readily exported, although some small quantities of China clay, soap-stone and a few other minerals were mined to a small extent for local consumption.

In 1926, the Department initiated intensive mineral development programmes undertaking special investigations for devising ways and means to utilise the available minerals for setting up suitable local industries, and also by taking up large scale mining operations, under direct Government control, in respect of a few of the mineral deposits. A chemical laboratory was fitted up for the Department, as an adjunct, for conducting assays and analyses of rocks and minerals and other investigations.

As a result of investigations on some of the non-metallic minerals carried out thereafter, the Government established a Porcelain Factory at Bangalore, a Cement Factory at Bhadravati, and a Paint Factory at Mysore; and with the aid of Government, a Stoneware Factory and a Glass and Enamel Factory have also been started, near Bangalore, by private enterprise.

Of the mining operations undertaken by the Department, a special mention may be made of the mining of the deposits of high grade chromite at Byrapur, in the Hassan District. In the course of about 12 years, 1926–38, by systematic open-cast mining to a depth of more than 100 feet below surface, over 50,000 tons of ore were raised; and a

sum of nearly 12 lakhs of rupees was realised by the sale of this ore. With a view to conserve the remaining portions of this deposit of high grade ore for the future needs of the State, the mining of this ore has been recently discontinued. The Departmental mining in respect of other minerals, *viz.*, graphite, asbestos, kaolin, quartz and felspar, which are required in the several industrial concerns of Government, has been steadily growing.

In addition to the mining of the abovementioned minerals extensive prospecting operations for ores of copper, lead and antimony, and for non-metallic minerals like corundum, kyanite, bauxite, limestone, etc., are being carried out in several parts of the State. As most of these works had to be done by ordinary trenching and shafting, the progress was rather slow and it was also difficult and expensive to test any of the deposits beyond a depth of 30 or 40 feet.

An advancement in the methods of prospecting has been made during the last three years when a Calyx Core Drill was added to the equipment of the Department. The testing of the mineral deposits to greater depths by drilling and a more intensive prospecting by careful classification and demarcation of the different grades of the deposits on the results of the systematic sampling and analyses of cores have since then been undertaken. The high calcium limestone deposits at Bhadigund, (now used by the Cement Factory at Bhadravati) and the chromite deposits of Byrapur have been already prospected by such drilling; the results indicating a reserve of over 2 million tons of high calcium limestone and over 40,000 tons of high grade chrome in the respective deposits.

A further advancement in mineral exploration and prospecting has been made recently by starting geophysical survey. A programme employing some of the electrical methods has been chalked out. During the last two years, surveys for the location of deposits of sulphide ores have been carried out by the spontaneous Polarization, the D.C. Equipotential line and the Resistivity methods. At a few localities the determination of the underground water table, by the Earth Resistivity methods has also been carried out in addition.

In addition to mere location and testing the extent of the mineral deposits, or mining those which are required for certain existing industries, it is necessary to ascertain to what specific purpose or purposes each of the larger mineral deposits would be best suited and how best the inferior material could be utilised as it is, or by processes of special treatment and concentration. To conduct these experiments the Department is now equipped with a small laboratory where investigations on ore crushing and concentration could be undertaken. This laboratory, which was fitted up in 1939, is equipped with a crusher, pulveriser, jig, a set of concentration tables, flotation unit and also an electric furnace. Some investigations on the concentration of graphite, kyanite, sillimanite and other minerals from low grade ores; the preparation of asbestos cement sheets from Mysore cement and asbestos; the calcination of soapstone for making metal polish and a few other investigations have recently been carried out in this laboratory.

There remains much to be done yet to make the best use of the available mineral deposits of the State. It is not possible to give here a detailed future programme of work of the Department, but the following main items will give some idea in which the Department will be engaged in investigations of mineral development and other branches of applied geology in the immediate future:—

(1) Deep underground prospecting on some of the auriferous lodes in the Honnali taluk.
(2) Geophysical survey of the sulphide zones and graphitic regions.
(3) Investigations on ore concentration,—specially graphite, refractories and corundum.
(4) Investigations on the suitability of some of the Mysore minerals for manufacture of chemical products.
(5) Investigation and classification of mineral deposits for specific purposes.
(6) Hydrographic and soil surveys.

B. Rama Rao.

A BRIEF NOTE ON THE ACTIVITIES OF THE DEPARTMENT OF HORTICULTURE

AMONG the factors that contribute to the health and happiness of the people of any country are abundant supply of 'protective' food including fruits and vegetables, pleasant surroundings and lung spaces in the form of parks and gardens for fresh air and light, and sports fields for exercise. For providing these, the Government of Mysore, through the Horticultural Department, have spared no pains in taking full advantage of the natural facilities existing in the State.

The activities of the Government Gardens Department which were confined only to a few public gardens and parks in the cities of Mysore and Bangalore have within the past quarter of a century spread far and wide in the State. The intensive efforts of the Department have resulted in the formation of a number of gardens, both public and private, in all parts of the State. Municipalities, District Boards, Village Panchayats and other local bodies have assisted in the planting of avenues and topes, and the formation of parks, squares, circles, etc., in various places.

The Government Botanic Gardens in Lalbagh and the Cubbon Park in Bangalore, the Curzon Park and Gordon Park in Mysore, and Dar-i-Dowlat Bagh at Seringapatam were the old well-known gardens and parks; we have now the famous Brindavana Gardens at Krishnarajasagara, besides many other parks and gardens which are of outstanding beauty.

The Horticultural Farm at Bangalore is the main centre of work on vegetable cultivation. Many new kinds and varieties of vegetables, grasses, etc., have been imported, acclimatised and distributed to the public in and outside the State.

As a result of a scheme for research on fruit cultivation put up by the writer before the Imperial Council of Agricultural Research at Simla in 1934, a Fruit Research Station has been established at a cost of Rs. 1,54,320 at Hessarghatta near Bangalore. The cost of land, buildings, water supply, etc., is met by the Government of Mysore, while the cost of maintenance—Rs. 46,200 for five years—is provided by the Imperial Council of Agricultural Research, Government of India. The opening of a Central Fruit Nursery at Lalbagh has been of great help in distribution of fruit plants. The Government have given much help in the shape of land, water supply, etc., for the revival of fig cultivation in Ganjam village which was once famous for figs. The grant of fruit cultivation loans is another step taken by the Government of Mysore for the encouragement of fruit cultivation. District Horticultural Inspectors are appointed to help garden owners in the cultivation of fruits and vegetables.

The Mysore Horticultural Society which is aided by Government does a great deal in creating interest in horticulture in the minds of the public. The result of the activities of the Society could be seen in the numerous beautiful gardens around houses in Bangalore and in Mysore. Two shows are held annually in which a great display of flowers, fruits and vegetables is made.

The Nandi Hill Station which is under the management of the Horticultural Department is popular as a health resort in summer. The Government have a motor road to the top of the hill constructed recently; this is a great convenience to the visitors to the Hill.

The numerous beautiful buildings, roads, boulevards, avenues, squares and circles, gardens and parks and illuminations not only in Mysore and Bangalore cities but in many towns and villages of the State are standing monuments of the keen interest and active support given during the past quarter of a century by His late Highness Sri Krishnaraja Wadiyar Bahadur and Amin-ul-Mulk Sir Mirza M. Ismail as Huzur Secretary and Private Secretary to His late Highness and later as Dewan of Mysore. It is certain that this field of work will receive the same support and encouragement at the hands of our present Ruler, His Highness the Maharaja Sri Jaya Chamaraja Wadiyar Bahadur who evinces keen interest in the activities of the Department.

H. C. JAVARAYA.

HYDRO-ELECTRIC DEVELOPMENT IN MYSORE STATE DURING THE PAST FOURTEEN YEARS

HYDRO-ELECTRIC expansion in the last fourteen years has been of considerable help in revolutionising the complete outlook of all the people of Mysore State. The forward policy of the Government, with their constant endeavour to develop the resources of the State in all ways, has necessitated the expansion of the natural power resources of the State as represented by its rivers. Nature has been reasonably liberal in her gifts of hydro-power under conditions making it easy for production of electric energy. The industrial development, seen in the erection of large factories producing various commodities in the different places in the State, has been made possible by the increase in power, made available for their development, and conversely the hydro-electric development has followed the demand for power for the various activities in the State. It can definitely be stated that the great advancement in the prosperity of the State has been largely due to its natural power resources and their ordered and progressive development under the direction of the Government. Electric power is no longer associated with lights only in the minds of the citizens, who realise that they enjoy its benefits directly or indirectly in all their daily activities.

The hydro-electric development of the State was one of the earliest in the East and started in 1902 with a power supply of about 5,000 H.P. to the Kolar Gold Fields, and has steadily progressed to about 75,000 H.P. with the completion of the Shimsha New Project in 1940. The Jog Falls Scheme is under active contemplation, and will produce an additional power supply of 32,000 H.P. in the first stage with an ultimate capacity of 96,000 H.P. in the final stage. This programme of expansion has been worked up by the Department and approved by the Hydro-electric Committee in order to meet the anticipated and prospective demands for power that will occur during the next 10 years.

In the year 1926 the Sivasamudram Plant had a capacity of 41,000 H.P. and was supplying the cities of Bangalore, Mysore and Kolar Gold Fields to the number of consuming installations as per statement given below.

	1925–26	1939–40
Load	23,200 K.W. or 30,900 H.P.	46,900 K.W. or 62,500 H.P.
Units generated	153,214,000	278,339,051
House lighting	9,422	41,223
Street lights	5,680	17,991
Power installations	318	5,241
Places electrified	3	Towns 200
Transmission lines	188	Miles 625

In 1940 the combined capacity of both Sivasamudram and Shimsha Stations is 75,000 H.P. The maximum demand has already reached 65,300 H.P. and the total capacity of the Stations will be in demand and service in the near future. This rapid progress in the State has been always kept in view by the Department, and the Jog Falls Project will come into service, when the demands for extra power make it necessary.

The most salient features in the development during the last fourteen years are the completion of the Ninth Installation works at Sivasamudram and the Shimsha Project, the construction of 440 miles of transmission lines and the electrification of just 200 cities, towns and villages throughout the entire nine districts of the State.

The Ninth Installation at Sivasamudram consisted in the erection of an 8,000 H.P. generating set in place of two old 2,000 H.P. sets, the realigning of the 2,200 volt cables from the generators to the low tension bus, and the construction of the Balancing Reservoir with automatic gates. The construction of the balancing reservoir was taken up to economise the use of water for power development. The construction of the Krishnaraja Sagar Dam as a hydro-electric and irrigation project imposed a limit on the issue of water for power production and it became imperative to economise water as power demands increased. The main idea underlying this balancing reservoir is to draw water from the combined rivers Cauvery and Kabbini, adequate to generate the average load demand, or in other words to store water at light load times and issue it to the turbines at heavy load times. Before its construction it was necessary to maintain

always a steady flow in Sivasamudram Power Canals capable of generating the maximum load demand on the Station, as there was no reservoir near the forebay from which water could be drawn when the load was above average, or in which water could be stored when the demand was below average. A reservoir of this nature should be located as near as possible to the forebay in order that extra water may be immediately available when required. The balancing reservoir is at a distance of about ¼ mile from the forebay and has an absorption and issue capacity of 26 million cubic feet of water. Issues from the reservoir are controlled by two automatic gates, operated electrically by means of floats in the forebay, so set and adjusted that the gates are raised or lowered as and when required to maintain a constant level in the forebay irrespective of the load, and the water demand by the turbines. The scheme has been entirely successful, and there is practically no spillage waste over the weir in the forebay. The actual savings of water during the hot weather, when storage water from Krishnaraja Sagar is required, is about 2,500 million cubit feet per annum.

The Shimsha development was sanctioned in 1937 and completed in June 1940 as per schedule and has added 23,000 H.P. to 46,000 H.P. at Sivasamudram to meet the developing demand for power. The maximum load demand on the Stations has been 65,300 H.P. and is rapidly increasing as further blocks of power will be taken up by several large power installations and extensions of power supply centres.

The Shimsha Project will be mostly a waste water project when completed in all respects after the dam across Shimsha River near Hagellalli is constructed to impound the waste and seepage waters from the lands irrigated by the Irwin Canals and the river discharges during the monsoon seasons. At present the Shimsha turbines are supplied with water drawn from the balancing reservoir at Sivasamudram. The gross head available at Shimsha is 636 feet in comparison with 420 feet at Sivasamudram and will thus develop one and a half times the power for the same flow of water. Two units of a total capacity of 23,000 H.P. are installed with provision for a third unit.

The following chart and statements give the load demand for the years noted based upon loads actually in view and the regular normal increase, the extent of the growth of electrification schemes and consumers, and the revenue realised.

The rivers Cauvery, Shimsha and Sharavathi are materially adding to the prosperity and happiness of the State in all respects, and the solicitude of His Highness the Maharaja and his Government for the welfare of each and every one of the subjects of Mysore in providing the amenities of life and the improvement of their economic condition finds no limit in the development of all the resources of the State according to well-developed programmes which require an assured and adequate power supply. The history of the hydro-electric development represents the corresponding increase in the various activities of the Mysore State contributing directly to the increase of wealth and happiness of the people.

S. G. FORBES.

INDIAN INSTITUTE OF SCIENCE

"THE late Mr. J. N. Tata desired to build and endow an institution which would provide Indian students with such facilities for work and training as would enable them to compete on equal terms with other countries as a producer of new knowledge and to aid Indian students to serve India in science and technology." As envisaged in this quotation the object of the Institute has been to train Indian students in methods of research in both Pure and Applied Science.

The activities of the various Departments of the Institute are briefly enumerated as follows:—

ORGANIC CHEMISTRY

A large amount of fundamental work in Organic Chemistry has been successfully carried out in this Department. Some of the more outstanding results relate to the Walden Inversion, Optical activity, Fatty acids, Synthesis of bicyclic terpenes, Heterocyclic chemistry, Asymmetric synthesis, etc.

In this Department there is a preparation section in which costly research chemicals required by the Department itself and others outside are prepared. The nucleus of what may be developed as an industrial concern for manufacturing fine chemicals has come into being. A number of natural products have been studied and the composition of several essential oils together with their methods of extraction have been successfully investigated. In addition a number of Indian medicinal plants have been examined with a view to making a complete analysis of their constituents.

GENERAL CHEMISTRY

Early studies included the cathode fall and spectra of rare gases and were followed by very accurate and painstaking investigation involving new technique and manipulative skill, on the atomic weights, compressibilities, refractive index and dielectric constant of rare gases of the atmosphere. The work of revision of atomic weights was extended to antimony and tantalum. The measurement of dielectric constants, refractive index and compressibilities of several other gases and vapours and the study of the influence of solvents on the dipole moment have formed subjects of more recent investigations.

A large number of early researches were directed to study the kinetics of reactions in solutions, such as esterification, hydrolysis, alcoholysis and acidolysis. Subsequent papers deal with the heterogeneous reactions such as oxidation, reduction and dehydration on the surface of metals, oxides and salts, and the application of thermodynamics to the equilibria involved in these reactions.

Photochemical studies include oxidation of toluene and benzaldehyde and quantum efficiency of cis-trans conversion of cinnamic acids. Under this heading mention should be made of the valuable contribution on the nature of reactions in electrodeless discharge.

Study of optical properties of organic compounds such as, Raman spectra of isomeric compounds, absorption spectra and rotary dispersion of isomeric terpenes and the relation between iodine value and refractive index, formed important part of more recent studies.

Colloid Chemistry.—The study of petrol water emulsions, detergent action of soaps, decolorising action of Fuller's earth adsorption and heats of adsorption by active carbon and silica gel formed some of the more important studies.

The physical properties of pure fatty acids, their glycerides and their mixtures and the phenomena of dimorphism, a mono- and tri-glycerides have also been studied.

Extensive investigations of the reactions of chromates and sulphates at high temperature have been made and have proved to be of considerable technical importance.

Manufacture of whitelead, thiosulphate and chromates from Indian chromites, refining of common salt, saltpetre and magnesium chloride, contact process of sulphuric acid and activation of carbon and Fuller's earth formed important part of industrial activities.

A large number of minerals have been analysed and in some cases new methods of analysis devised.

BIOCHEMISTRY DEPARTMENT

I. Contribution to the Development of Technical Mycology in India

(*a*) *Power alcohol.*—Experiments on the production of power alcohol from rice straw

and other cellulosic materials were successfully carried out in the Department and one of the workers in this line was employed by the Burma Oil Co., in connection with a scheme for the production of power alcohol from paddy straw.

(*b*) *Power gas.*—A process for the production of power gas from waste vegetation by its fermentation in septic tanks was developed.

(*c*) *Vinegar.*—At the request of the Government of Hyderabad a process for the manufacture of vinegar from alcohol was evolved which was subsequently taken up by Messrs. Cross and Blackwell Co.

(*d*) *Acids.*—Experiments on the production of lactic, gluconic and citric acids are now in progress.

II. Contributions to the Indian Lac Industry

The Department has pioneered researches on the entomological, sylvicultural and industrial aspects of the lac industry. The Department has been responsible for training a number of chemists and entomologists for this industry and it is a matter of pride to the Department that most of the members on the Chemical Staff of the Indian Lac Research Institute at Ranchi, are past students of the Institute.

One of the senior members of the staff of the Biochemistry Department has contributed largely to the development of the lac industry in Mysore and Madras. He was the consultant to the Government of Mysore on lac for a period of three years, during which period the cultivation of lac was put on scientific lines and a factory put up in Bangalore.

A considerable amount of work has been done on the industrial use of lac, one outstanding result of this has been the production of insulating varnish which has been used for the impregnation of transformers by the Government of Mysore.

Another line of work where the increased employment of lac has been ensured is the production of pigmented lacquers which has been developed. Promising results have been obtained in the direction of preparation of moulding powers from lac.

III. Utilisation of Trade Waste

Glue and Gelatin.—A process for the manufacture of glue from fleshings and gelatine from sinews was perfected in this Department.

Vegetable casein from nonedible seed cakes was prepared by a process which has been patented by the investigator. This casein has been found to be of considerable value in the preparation of distempers and water paints.

A large amount of work has been done in the Department on the utilisation of molasses which is a bye-product of the sugar industry. In addition to its employment in a raw material for the production of power alcohol its efficacy as a manure providing carbonaceous material for nitrogen fixation and thereby increasing the fertility of the soil has been thoroughly investigated in this Department.

Experiments on the employment of molasses for the solubilisation of the important constituents of the soil has also been investigated in a very detailed manner.

With a view to facilitate the transport of molasses, attempts have been made to solidify the products. This object has been successfully achieved by an admixture of quicklime and molasses which results in a powdery mass which can then be transported easily. This has been made the subject of a patent by the investigators. This product has been produced on a commercial scale and is being tried as a manure in the experimental plots in the sugarcane farm at Mandya.

IV. Contributions to Agricultural Industries

One of the more recent investigations on the utilisation of agricultural produce has been the production of malt from ragi. The ragi malt has been found to be superior to the one from barley in several respects. It has been found that it has a higher amount of assimilable calcium, higher amounts of vitamin B_1 and B_2 and traces of the essential elements like copper and manganese.

A large amount of work has been carried out in the preservation of fruit and fruit juices and also in the preparation of jams and jellies from various kinds of fruits. The Department has been the first to investigate the possibility of preserving mangoes, which has now been taken up by several canning factories in India.

V. Contribution to Economic Forestry

One of the major investigations which was carried out in the Department was the problem of the spike disease of sandal which was entrusted to the Institute by the Governments of Madras and Coorg. The investigation was carried on in an intensive manner for a period of 6½ years. Apart from the several fundamental advances which were made in forest pathology, it was found that the disease is carried by certain groups of insects. A considerable amount of light was thrown on the mode of natural dissemination of disease. This information has been of value in devising methods of effectively controlling the disease under sylvicultural conditions. It was found that the host plant of sandal plays a fundamental part in imparting immunity to sandal and this finding has been of great assistance in controlling disease in a more effective manner.

VI. Contributions to Foods and Nutrition

The biological value of several diets prevalent in different parts of the country has been examined. Investigation on the proteins of Indian foodstuffs have been carried out and in this respect the Department has acted as the pioneer. Several important investigations have been carried out on butter and ghee, especially with regard to their vitamin A contents. This work has been recognised by the Government of India and has been taken into consideration in organising grading centres for ghee in the country. One progressive firm in Bombay has taken up the manufacture of ghee under the advice and direction from one of the members of the staff.

The most important line of investigation in the field of foods is the research on the quality of rice which is being carried out with the help of a grant from the Imperial Council of Agricultural Research. Valuable results have been obtained.

The Imperial Council of Agricultural Research has financed a scheme for the preparation of organic manures by composting. The results of these researches have been widely applied in different parts of the country.

A considerable amount of work on fundamental Biochemistry has been carried out particularly in the field of enzymes, proteins and viruses and micro-chemistry. This work has been recognised by eminent authorities in the subjects.

ELECTRICAL TECHNOLOGY DEPARTMENT

The all-India character of the Institute is always kept in mind and the attempt is made to get the best students from all parts of India. Thus the students live in constant social contact with others from all parts of India.

Important additions were made to the Department in 1925 when the high tension laboratory was added providing testing facilities up to 350,000 volts, in 1927 when the radio laboratories were added, where also is housed the equipment which is recognised by the Government of India as the national standard of frequency. The south wing was added in 1932.

Alongside the teaching work there has always been a certain amount of research work. Investigations in different aspects of heavy and light current engineering have been conducted and the results have been published in technical journals in India and abroad.

The *Journal of the Electrical Engineering Society* has now become well established as an electrical engineering journal in India and is the only one of its kind in the country.

DEPARTMENT OF PHYSICS

In the Department of Physics work of fundamental importance is being carried out successfully in all departments of the subject, Magneto-optics, X-rays, Electron-diffraction, Ultrasonics, Colloid Physics and so on to mention only a few. The diversity of the subjects successfully tackled by the Department reflects the versatile character of the scientific interest of the distinguished physicist under whose inspiring guidance the members of the Physics Department are working. Its achievements are so varied and in various ways are so well known to the public that it is unnecessary to dwell on them in any detail.

Such in brief is a summary of what the Institute has done during the last 14 years. There is a great future for the Institute and it is the earnest hope of all interested in the welfare of our country that the Institute should occupy a predominant place of usefulness in the Industrial and Scientific life

of India. The Government of His Highness the Maharaja of Mysore have always taken the greatest interest in the affairs of the Institute, and their recent decision to restore the original grant of Rs. 50,000 a year testifies to their keen solicitude in its welfare.

FUTURE PROGRAMME OF WORK

The following new schemes of Industrial Research will be undertaken:—

Department of Chemistry:

(i) Manufacture of formaldehyde from methyl alcohol and of ethyl acetate and acetic acid from ethyl alcohol.

(ii) Manufacture of urca from ammonia and carbon dioxide for use as fertilisers.

(iii) Utilisation of phosphatic nodules of Trichinopoly as phosphate fertiliser.

(iv) Manufacture of sodium cyanide.

(v) Study of refractories and furnaces.

Laboratory preparation of the following types of drugs to be followed by semi-large scale operations:—

(i) Antimalarials, Atebrin, Plasmoquine and allied substances;

(ii) Drugs to combat bacterial infections; sulphanilamide, dagenan, prontosil, etc.

(iii) Antisyphilitic drugs; Neosalvarsan, M-amino-p-hydroxy-phenylarsineo-oxide-hydrochloride, etc.

(iv) Intestinal antiseptics like Dimol, carbarsone, etc.

(v) Hypnotics, veronal, prominal, phanoderm and allied substances.

(vi) Analgesics and local anæsthetics, etc.

Department of Biochemistry:

(i) Technology of fermentation;—

The Department has been made responsible for a national collection of type cultures relating to technical mycology.

(ii) Technology of food products.

Department of Electrical Technology:

This laboratory will be developed as a centre of radio research.

J. C. GHOSH.

INDUSTRIAL LABOUR IN MYSORE

MYSORE, fast growing in its industries, is also growing in its industrial labour population, with its attendant problems of labour organisation, factory regulation, workmen's compensation, conciliation of industrial disputes, maternity benefit, housing, recreation, etc. Industries in Mysore can be classified under the following heads:—

1. Major industries like cotton, woollen and silk mills, railway and engineering workshops, iron and steel works, generation and distribution of electricity, sugar factory and brick and tile works.

2. Minor industries like sandal oil and soap factories, cotton gins, rice, flour and oil mills, tanneries, printing press, porcelain, glass and enamel works, fertiliser and chemical factories, etc., using power and employing 20 or more persons.

These two categories of industries come under the Factory Act. There were 250 such concerns in the State during the year 1937–38, out of which 48 were seasonal. The average daily number of operatives employed in all the factories was 25,526, of whom 19,409 were men, 4,581 were women, 449 adolescents, between the ages of 15 and 17, and 1,087 children between 12 and 15 years of age working half-time.

3. Mining industry, especially the production of gold in the Kolar Gold Fields employing on a daily average of 23,122 labourers. There is besides iron and chrome mining, which employ a much smaller number.

4. Plantations, principally of coffee and cardamom extending over a lakh of acres and employing on an average 29,000 of whom 10,000 are women. Not much attention is being paid towards the welfare of these labourers.

The problems connected with labour employed in the above industries vary according to the nature of the industry and therefore of the conditions of work. After the last European War and particularly with the organisation of the International Labour Office in Geneva, the discussions and conventions formulated from time to time, the responsibility for the protection and welfare of labour began to be considered as one of the prime functions of Government. Besides, industrial labour in all parts of the world began to get organised and to claim their right for united representation of their needs and grievances. And the growth of democracy, adult suffrage and the ballot box, gave to the masses their rightful position in shaping the destinies of their nation and of themselves.

In Mysore, where Government were keenly interested in the promotion of industrial prosperity, problems relating to labour welfare began to engage their attention. In 1920, the Director of Industries and Commerce wrote as follows in his report to Government. "As an industrial factor of considerable importance reference must also be made to the awakening among the labouring classes which has begun to manifest itself though perhaps in a crude form. The discontent which resulted in numerous strikes in the large industrial concerns of India has not left Mysore entirely unaffected .... While it may be premature in our conditions to have a separate Labour Commissioner or other organisations, I am of opinion that the Department of Industries and Commerce should study and keep in touch with labour conditions and labour problems of the State, and from time to time take such action as may be proper and suitable to maintain a good understanding between employers and workers." And every year there were strikes and disturbances, their causes being chiefly due to retrenchment and dismissal, refusal of bonus or gratuity, fines, demand for holidays and increased wages, victimisation for organising labour unions, etc. As the result of such constant friction between employers and employees, the Government of Mysore ordered in 1926 the appointment of the Director of Industries and Commerce as the ex-officio Labour Commissioner to deal with all questions relating to the welfare of labour. Earlier in 1925 Government amended the Factory Regulation, providing for the inspection of factories, regulating hours of work and minimum age of employment, and in 1927, they enacted the Workmen's Compensation Regulation for the payment of compensation for injuries caused to workmen. The Labour Commissioner was also appointed as the Chief Factory Inspector and

the Workmen's Compensation Officer. In addition the District Magistrates were also empowered to inspect factories and decide Workmen's Compensation cases.

With their constant solicitude for the welfare of the people and their modern and progressive ideals in administration, Government have further amended these Regulations and brought them into line with the Acts in British India, consequent on the various recommendations made by the Royal Commission on Labour, whose very informing report and liberal recommendations form the *Magna Charta* for Indian Labour. Curiously enough agitation has also been coming from the employers and capitalists in British Indian Provinces that labour conditions in the Indian States were very backward and thus worked as a handicap for their own industrial growth.

The Mysore Factories' Act of 1936 has fixed the maximum hours of work at 54 a week and 10 a day in non-seasonal factories, and 60 a week and 11 a day in seasonal ones, with compulsory weekly holidays and daily rest intervals. Children below 12 are prohibited from employment, and between 12 and 15 as half-timers, and no work at night for either children or women. Over-time work is to be given extra pay. Factories should submit periodical returns and be regularly inspected, and provisions have been made for maintaining them in clean, well-lighted, and sanitary condition, machinery well protected and also adequate shelters for the workers during the rest period and creche for the children of women employees. Prosecutions and penalties have been provided in the Act for contravention of the prescribed rules and regulations.

The Workmen's Compensation Act of 1936 gives relief to all factory, mine and railways workers, as also to those employed in motor transport, manufacture of explosives, construction of engineering works, and all other hazardous occupations. The amount of compensation to be paid is laid down, on a fairly liberal scale, according to the nature and incidence of the accident, and in the case of fatal accidents, the dependents will be given the benefit. The Motor Transport Act has prescribed the maximum hours of work for drivers and conductors and has provided for rest periods.

The Mysore Maternity Benefit Act was enacted in 1937, prescribing the grant of leave with pay 4 weeks before and 4 weeks after confinement, to all women employees in factories. The Act also protects the women from being dismissed during the period of benefit, and provision is made for conviction of the employer to a fine for contravention of the rules.

The Mysore Mines Act, passed in 1906, provides for regular inspection of the mines, proper safety for the employees and provision of ventilation, light and water. Though the Act does not fix any hours of work, the Kolar Gold Mining authorities have adopted an 8-hour shift.

With regard to plantation labour, there is no specific Act, but in 1933 the Government repealed the Workmen's Breach of Contract Act and the relevant sections of the Penal Code, thus abolishing forced labour and criminal penalties for breaches of contract.

Labourers throughout the world and in India, have won for themselves a position of security and proper treatment by their power of organisation and unified action. It has unfortunately been a case of continued conflict and wringing out a share in profits and privileges from the unwilling hands of employers and capitalists. It is only by a well-devised scheme of co-partnership that peace can be established in industrial relationship. Labour in Mysore has been no exception. They grew in class consciousness, and every strike or lock-out brought forth added organisation and leadership. In 1927, the then Labour Commissioner stated as follows:—

"In the disorganised condition of labour, it was difficult to formulate their grievances and to seek suitable remedies at the hands of the employers .... The growing consciousness of labour is well illustrated by the readiness with which associations of persons employed in certain trades are formed .... It is desirable that an enactment analogous to the British Indian Trade Union Act should soon be passed in the State. In the absence of such legislation it is difficult for labour to organise itself on proper lines and their leaders suffer under serious disadvantages. The frequency of labour disputes and the absence of suitable machinery to avert or terminate them satisfactorily point to the need of legislation facilitating the institution of conciliation or arbitration boards." But uptill now in spite of repeated representations, neither the Trade Union Act nor the

Industrial Disputes Act has been enacted in the State. Government have, however, constituted in 1931 the Conciliation Board, which has recently been enlarged as the Labour Welfare Board, to deal with a wide range of questions affecting industrial labour. The Labour Commissioner is the ex-officio Chairman of the Board and amongst the members are representatives of the employers, the employees and the public. The Board meets periodically to review the relationship between labour and capital, propose methods of settling differences, recommend to Government to take suitable action, and generally consider all questions affecting labour and refer them to the employers. Above all, under the administration of our present Dewan, Sir Mirza M. Ismail, who takes a personal interest in the welfare of labourers, they have been able to secure a great many advantages in the way of better housing, increased wages, and satisfactory settlement of their needs and grievances. He has also been a great exponent of labour welfare settlements, where the educated youths of the country will learn to mix freely with labourers and render service to them. At his instance the Mysore University Social Service Settlement has been formed in Bangalore on a permanent basis.

The major employers of labour in the State,—and it must be said to the great credit of the European employers in particular the managements of the Kolar Gold Mines and the Binny Mills,—have established good and sanitary housing colonies for their workmen, medical relief and maternity hospitals, day and night schools, recreation and games, co-operative societies and cheap credit banks, etc. Government are also spending large sums of money to provide all these amenities to the labourers in their concerns, the Bhadravati Iron and Steel Works, the Mandya Sugar Factory and the Krishnarajendra Mills. The Managers of the Maharaja and Minerva Mills in Bangalore have built quarters for some of their workmen and are proposing to build more, and they also run very useful co-operative stores and banks. In addition they are contributing very liberally to a private organisation—the Seva Ashram Home of Service for Labourers—to carry on educational work. The Bangalore City Municipality have spent over a lakh of rupees in laying out a Model Labour Colony with sanitary and lighting conveniences and constructing 250 tiled houses, which are rented out to labourers for two rupees a month. Other Municipalities in the State are also planning extensions for industrial establishments and labour housing.

Other important pieces of legislation for the protection of labourers have been the amendments of the Civil Procedure Code exempting the salaries of labourers below Rs. 50 per month from attachment towards debt, and protecting honest debtors from detention in jail. The recent Mysore Money-lenders Act is a very comprehensive regulation for the registration of money-lenders and prescribes the proper maintenance of accounts, grant of receipts, the maximum interest chargeable, etc., all of which are very helpful to protect the unwary and needy labourers from becoming victims to the usurious and unscrupulous money-lenders and pawnbrokers. It is indeed no loss but a great boon, if credit is made unavailable to the monthly wage-earning labourers. Government have also ordered the closure of drink shops on pay-days in the industrial towns of Bhadravati and Mysore, and are contemplating similar steps in Kolar Gold Fields, Bangalore City and other places.

In the political field, Labour has at present two seats in the Representative Assembly and one in the Legislative Council, all of them being filled by nominations by Government. But in the forthcoming New Reforms, Labour has been given three seats in the Assembly and two in the Legislative Council, to be elected by the enfranchised labourers from amongst themselves. Thus in future labour in Mysore can well look to their own leaders to secure for them their just needs.

T. RAMACHANDRA.

INDUSTRIAL PROGRESS IN MYSORE DURING THE PAST FIFTEEN YEARS

THE year 1926 can be rightly said to mark the beginning of Industrial Renaissance in Mysore. In reviewing the development of the State during the past decade *'The Great Britain and the East'* writes as follows:—

> "While agriculture has received its rightful share of attention in the economy of the State, its industrialisation has been pressed forward with vigour. ... It is indeed in this latter direction that progress has been most marked. Whether in basic, cottage, small- or large-scale industries the advancement achieved in the last decade has been truly remarkable, and as stated above, has won for the State a position envied but not eclipsed elsewhere."

The Government of Mysore have been following for over half a century and particularly since the year 1926, a policy of vigorous state effort towards progressive Industrialisation. They have assisted the promotion of industrial enterprise in the State in several ways, more important of which are the following:—

1. Establishing Industrial Concerns owned and controlled by Government in the larger interests of the State.

2. Pioneering of Industries with a view to handing them over ultimately to private enterprise.

3. Providing financial aid under the rules regulating the grant of loans for Industrial and Agricultural purposes, by giving *taccavi* loans and supplying plant and machinery on the hire-purchase system.

4. Encouraging private enterprise to start large-scale industries on a joint-stock basis by the grant of concessions on the following lines:—

(i) Subscribing to the share capital of the concerns.

(ii) Granting land, water and electric power free of charge or at concession rates.

(iii) Guaranteeing the purchase of the products of concerns to the extent of their requirements provided quality and price are satisfactory.

5. Opening of departmental show-rooms in important cities like Bombay, Madras, etc., to find a market for the products of Mysore Industries and to popularise them.

During the period under review, as many as 26 major industrial concerns were established in the State. Most of these Industries are what may be termed as 'Basic' or 'Key' Industries. The addition of a steel-making plant to the Bhadravati Iron and Steel Works, establishment of factories for the manufacture of paper, cement, porcelain insulators and other electrical materials, electrical transformers, workshop machinery and machine tools, lac products and paints, bakelite articles, sugar and power alcohol from molasses, stoneware pipes and potteries, electric lamps, sulphuric acid and other heavy and fine chemicals, fertilizers, flue cured tobacco, vegetable ghee, cured coffee, glass and enamel ware, electric storage batteries, spun silk yarn, pharmaceutical products and chrome-tanned leather. These are some of the important additions that have been made to the long list of industries that were already in existence.

There are now as many as 31 major industrial concerns (excluding the Hydro-Electric Works, textile mills, in Bangalore and the Gold Mining Companies in Kolar) with a total capital investment of about 510 lakhs of rupees and employing about 17,000 persons.

Under the Rules for the grant of loans for Industrial and Agricultural purposes, the Department has granted loans amounting to as much as Rs. 17½ lakhs to private enterprise for starting and developing industries. These have been supplemented by private capital to the extent of Rs. 25 lakhs. Technical assistance and advice is also rendered by this Department in the erection of a large number of Industrial Installations and so far 718 installations at an approximate value of Rs. 23 lakhs have been put up by this Department.

As a result of the liberal State Aid granted to Industries, particularly from the year 1926, in several directions as enumerated above, apart from the several kinds of industries employing less than 10 people there are now as many as 370 large Industrial

Concerns in the State, each employing on an average 10 or more persons per day. The average daily number of persons employed on all these concerns is as many as 66,000.

While encouraging the establishment and growth of large-scale and medium-sized industries, the Department is equally alive to the importance of Minor and Rural and Cottage Industries.

The Department of Industries has prepared a Three-Year Plan of Development of Rural and Cottage Industries involving an expenditure of nearly Rs. 1½ lakhs, which the Government of Mysore have been graciously pleased to sanction. The Programme of Development provides for the reviving of village industries which once existed in the State but which, owing to various causes had languished, and for the starting of new village industries in suitable centres. Under this scheme, already a number of village industries such as tanneries, tile works, paper making, envelope making, hardware and smithy, lacquerware, improved pottery making, coir making, hand spinning, hand-loom weaving, sericulture, etc., have been introduced in a number of centres in the State.

Sericulture is an important industry in the State practised on cottage industry basis, providing occupation to nearly one-eighth of the population. During the past fourteen years, Government have been pleased to spend as much as Rs. 27 lakhs to develop this industry as a result of which sericulturists in the State have been benefited greatly. The important place which the Sericultural Industry in Mysore occupies in the Indian Silk Industry, is due entirely to the large and liberal financial and technical assistance of Government who are keen about the development of this industry and are solicitous in the welfare of a large portion of the population depending upon it. Next in importance is the hand-loom weaving industry. There are as many as 30,000 looms in the State providing occupation to nearly 30,000 families. This industry is in the throes of distress owing to competition from organised industry on the one hand and want of knowledge of improved methods on the other. In order to revitalise this industry and place it on a sound basis the Department has been doing a great deal of work. The weaving demonstration staff of the Department has conducted demonstrations in a large number of weaving centres in improved methods of weaving. The Department has spent more than two lakhs of rupees on this account during the past eleven years and the value of improved appliances introduced amounts to more than Rs. 24,000.

The supply of cheap electric power has given an impetus to hand-loom weavers to instal power looms. There are, at present, about 800 power looms.

With a view to improving the condition of hand-loom weavers, the Department has opened yarn depots in a number of centres. These depots are purchasing yarn in bulk and are supplying the same at cost price, thus saving middleman's profit to the weavers. The depots are also furnishing weavers with improved and readily saleable designs.

As a result of these activities, the hand-loom weaving industry has been able to regain much of its lost ground and hold its own against competition and handicaps.

The programme for the future includes the intensive development of the hand-loom weaving industry, medium-sized, minor and cottage industries and marketing organisations among other activities of the Department.

The facts and figures furnished above are sufficient to indicate that the History of Mysore Industries during the past decade is a History of a systematic and continuous development, which is largely due to the 'enlightened guidance' of the Dewan, whose 'advice on the development of the resources of the State' and personal encouragement has done much towards fostering that 'Spirit of enthusiasm which is the basis of success'.

B. G. APPADURAI MUDALIAR.

THE PROGRESS MADE IN IRRIGATION, CIVIL WORKS AND COMMUNICATIONS

THERE has been a general improvement in the activities of the development departments of the State during the last fourteen years.

Irrigation

The grants for irrigation works, which stood at about 5 lakhs in the year 1926, has steadily increased during the past 14 years, to about Rs. 21 lakhs in 1939–40 and to Rs. 27 lakhs during the current year. The increased grants have facilitated the construction of several big irrigation works, protective as well as productive, in the several parts of the State with the result that irrigational facilities are extended all over the country. It has been the recognised policy of Government to mitigate the distress in arid tracts by constructing reservoirs and a special fund known as the Irrigation Development Fund has been created for this purpose. In order to ensure a steady progress on the restoration of tanks, whose capacities get impaired due to silting or other causes, a consolidated triennial programme has been prepared for being pursued systematically. Action is being taken to use the water in the tanks as economically as possible by the use of siphon spillways and modern designs of sluice shutters.

Among the major irrigation works taken up and completed during the past 14 years, may be mentioned (1) the Maralwadi tank in Kankanhalli Taluk, (2) the Thumbadi tank, Koratagere Taluk, (3) Kamasamudram tank, Bowringpet Taluk, (4) Nidasale tank, Kunigal Taluk, (5) Dalavoy tank, Chicknaikanhalli Taluk, and (6) the Marconahalli Reservoir, Kunigal Taluk. Several large irrigation works are also in progress, chief among which are (1) Alahalli tank, Kankanhalli Taluk, (2) Byramangala tank, Closepet Taluk, (3) Markandeya tank, Bowringpet Taluk, (4) Thippaganahalli tank, Goribidnur Taluk, and (6) Kanva tank, Chennapatna Taluk.

By far the biggest irrigation work of the period is the Irwin Canal from the Krishnaraj Sagar which was started in 1927. The main canal is 28 miles long up to the Hulikere tunnel and is bifurcated beyond the tunnel to two branches, the Maddur Branch and the Cauvery Branch. Works are nearly completed on the Maddur Branch and on the Shimsha and Kergod branches taking off from the Maddur Branch. The Cauvery Branch Works are in progress round about Hebbakvadi and Turuganur. Out of the extent of 1·2 lakhs of acres proposed for irrigation under the channel, an extent of nearly 55,000 acres are already under the plough. Irrigation of a tract so extensive as this has its own special problems which are being dealt with by the co-operation of the Irrigation, Agricultural, Revenue and the Health Departments. Elaborate surveys were made all over the irrigable area to determine the nature of the soil and to take suitable precautions in advance to prevent waterlogging and salinity. The system of irrigation known as the 'Block System' has been specially adopted with a view to prevent waterlogging and malaria in the irrigated tract. An agricultural farm is being run at Ganadalu near Mandya to educate the farmer and to advise him on the selection of crops. The main crops grown in the Irwin Canal tract are paddy, sugarcane and irrigated dry crops. In order to consume the sugarcane grown, a Sugar Factory has been started at Mandya through Government help. Further extension of irrigation in the Cauvery Branch is proceeding rapidly.

The extension of the hydro-electric works at Sivasamudram and Shimshapura has been possible owing to the availability of water from the Krishnaraj Sagar all round the year. The Krishnaraj Sagar Works are being worked as a combined irrigation and hydro-electric scheme with great success.

In order to keep pace with the growing demands for electric power in and outside the State owing to the industrialisation of the area, Government have just sanctioned a scheme for generating 48,000 H.P. at Jog and the works on the construction of the main storage dam at Hirebasgar are under progress.

Civil Works

The period from 1926 to date marks an era of continued progress on the construction of modern buildings in the State. A separate Architectural Section has been

constituted to furnish well-considered designs for the structures proposed for construction.

The construction of buildings for hospitals and wards all over the State is a special feature in the programme of building construction during the period. As a result of the personal contact of the Dewan with the leading public men of the various places, liberal donations have been paid by philanthropists for the construction of dispensaries and maternity homes without taxing the finances of the State heavily. Similar progress is also in evidence in the case of educational institutions. The buildings, parks and gardens brought into existence during the past 14 years have not only immensely benefited the people of the State but also increased the artistic beauty and improved the public health of the several towns and cities. Another memorable event of the period is the renovation of Belur and Halebid temples, the monuments of ancient Indian sculpture.

Communications

There has been a remarkable improvement in the maintenance of communications during the past 14 years. The improvement in the road surface is keeping pace with the growing needs of fast vehicular traffic. The District Boards and Village Panchayats are endeavouring to open inter-village roads in the interior parts of the State and to connect them with the thoroughfares. The arterial roads are painted or premixed with bitumen emulsion to suit modern high-speed traffic and to avoid the nuisance of dust. Cement concreting of roads is undertaken as an experimental measure in selected stretches of the more important roads. The portions of through routes running through the hearts of towns or busy villages are deviated outside the towns to avert accidents. The ghat roads are straightened and widened at curves at a heavy cost with the result that the journey over them which was once considered difficult and almost risky is now made easy and comfortable. A visitor to the State need no longer be perplexed on any cross road as different signs and name boards are put up on different types of roads in accordance with international standards. A separate road fund and Traffic Board are created to ensure proper attention to roads. Special attention is being paid to the planting of avenue trees.

Bridges

The big rivers and small streams cutting off communications are being steadily bridged. The work in this direction is going on hand-in-hand with the improvements of roads. Fording the rivers on main roads with inconvenience is fast becoming a thing of the past.

Several important bridges have been built over the main rivers partly with the help of the reserve funds with the Government of India. Among the major bridges built during the period may be mentioned the Gorur and Akkihebbal bridges over the Hemavati, Ramanathapur and T. Narasipur bridges over the Cauvery, Kapila bridge at T. Narasipur and the Shimsha bridge at Halagur. A number of small bridges have also been constructed in Kadur and Chitaldrug Districts from the Railway Cess Funds of the District Boards.

The Tunga bridge at Thirthahalli is under construction. A programme of bridges yet to be built as funds permit is being prepared from time to time.

Water Supply

By constructing a reservoir at Thippagondanahalli for supplying pure water for drinking purposes to the growing population of Bangalore City and Civil and Military Station, the administration of the period has offered a boon to the Municipalities and to the public.

Several water supply schemes have been executed in the moffusils.

Miscellaneous

Improvements in the drainage system of towns, the layout of extensions in towns and cities and of parks and public resorts are progressing steadily. Drinking water wells are being provided in increasing numbers in the rural parts.

An Aerodrome at Jakkur near Bangalore is in service and another at Mysore is being formed. Service from Madras to Hyderabad *via* Bangalore is also opened.

Opening a broadcasting Radio Station in the State is also under contemplation.

N. Sarabhoja.

THE MYSORE CONSTITUTION

AMONG the Indian States, Mysore occupies the foremost place on account of its size, population and revenue combined with its progressive and up-to-date administration. Modelled on British Indian lines during the days of British Commission which was in charge of the administration of the State for quite half a century from 1831, to 1881, it compares most favourably in point of efficiency with that of any province in British India. It has further had the advantage of being under the control of good and benevolent rulers who identified themselves with their subjects and whose only aim was the promotion of their happiness and prosperity. One of the first acts of His Highness the Maharaja Chamaraja Wadiyar Bahadur on his assuming the administration of the State in 1881 was the establishment of the Representative Assembly—an unique institution and the first of its kind anywhere in India, the object of which was to associate the people of the State with the administration by inviting their leading representatives to the Assembly and giving them an opportunity of getting acquainted with the measures and policies of Government and of giving expression to their views thereon as also to the wants and grievances of the people in all departments of administration. The members of the Assembly were in the beginning, nominated by Government; but in course of time, all the seats in the Assembly were thrown open to election and several other privileges were also given to its members from time to time. The next step towards the liberalisation of the administration was taken in 1907 by the establishment of the Legislative Council to associate the representatives of the people in the making of laws, which had till then been solely the function of the executive Government. Fifteen years later, with a view to satisfy the desire of the people of the State for an extension of the powers and privileges of both the Representative Assembly and Legislative Council, a mixed committee of officials and non-officials with Dr. Sir Brijendranath Seal, Vice-Chancellor of the Mysore University, was appointed in 1922 to go fully into the question and submit proposals; and on the receipt of the Report of the Committee, the Representative Assembly and the Legislative Council Acts of 1923 were passed according to which the strength of these bodies was increased and certain additional privileges were given to them—such as the power to make interpellations and move resolutions, to discuss the annual budgets and vote on demands for grants, etc. With the advance of time and with the far-reaching changes that were introduced in the British Indian Legislatures under the Government of India Act of 1935, there was a demand in the State also for a further measure of reforms and also from a section of the people for a form of Responsible Government. In response to this demand, the Government again constituted in 1938 a Committee of 26 persons—of whom all but 2 were non-officials, representing all interests and communities to go thoroughly into all questions relating to the constitution of the State; and on the recommendation of the Committee, His Highness the Maharaja sanctioned in November, 1939, several far-reaching reforms calculated to further liberalise the constitution and associate the people more largely with the Government in the administration of the State. These reforms are all embodied in the Government of Mysore Act promulgated by His Highness, in April, 1940 and the Rules issued thereunder. It was, at first, the intention of Government to introduce the reforms during the current year itself by having the elections for the new Representative Assembly and Legislative Council conducted in the month of August last, but in view of the representations made to Government for a postponement of the elections owing to the inconvenience to which the voters and candidates would be put if the elections were held during the monsoon season, the Government have decided to have them postponed to an early date next year so that the new constitution may be brought into effect by the next Birthday session of the Representative Assembly.

2. A brief account of the new Constitution as sanctioned by His Highness the Maharaja and expected to be soon brought into effect will now be given. Taking up first the Representative Assembly, the maximum strength of the Assembly which is 275 at present will be raised to 325 under the

new Constitution, mainly by increasing the number of seats reserved for Mahommedans from 18 to 30 and for depressed classes from 6 to 30 (five times the present number) and providing 11 seats for women against only 4 at present. Of these, excepting 12 seats which may be filled by nomination by Government all the others will be thrown open for election. The Assembly will have the right to be consulted on every measure of legislation proposed to be introduced either by Government or by any private member before it is taken to the Legislative Council, emergent situations being met by the passing of temporary ordinances which will not be in force for more than a year under any circumstances. Any bill, either Government or private, which is opposed by a majority of two-thirds in the Assembly will not be taken before the Legislative Council, except in rare cases wherein Government consider it necessary to proceed with any Bill of theirs in public interests or for ensuring safety and good Government. In such cases, the Government should issue a statement explaining their reasons for proceeding with the bill notwithstanding the opposition of the Assembly to it. The franchise for the Assembly will be extended by lowering the property and educational qualifications of the voters so as to double their number immediately and increase it still further in course of time. The members of the Assembly will continue to enjoy the same privileges as at present in the matter of interpellations, representations and resolutions but the restriction placed on the number of interpellations, etc., which can be tabled by any member will be removed. The members of the Assembly will be empowered to discuss the annual Budget but demands for grants will not be placed before them and subjected to their voting.

3. Coming next to the Legislative Council, its present strength which consists of 53 members of whom only 21 are elected and the remaining 32 are nominated by Government, will be raised to 68 consisting of 44 elected members and 24 nominated members. The elected members will thus hereafter be in a decisive majority of about two-thirds and can therefore effectively influence the decisions of the Council. The Council will have the power to discuss the Budget and vote on the demands for grants for all Departments of Government, excepting a very few excluded items such as Palace, Pensions, Sinking Fund, Interest on Loans, etc. The salary of every officer of Government including the Dewan will be subject to the vote of the Council. The Dewan is, however, empowered to restore a demand rejected by the Council if, in his opinion, its rejection would affect the carrying on of any Department or the due discharge of the Government's responsibility. The Legislative Council will, instead of being presided over by the Dewan as ex-officio President as at present, hereafter have the privilege of electing its own President from among its members except that for the first term of the new Council the President will be appointed by His Highness the Maharaja. There will also be an elected Deputy President, an office which is newly created.

4. The most important feature of the new reforms will be in respect of the appointment of the Ministers. Whereas at present there are only two ministers (designated as Executive Members of Council) appointed by His Highness from the service, there will be not less than four ministers under the new Constitution, of whom two *at least* will be appointed by His Highness from among the *elected* non-official members of either the Representative Assembly or the Legislature. All the ministers will be ex-officio members of the Legislative Council. They will not be removable by a vote of no-confidence by the Legislature but their actions and policies may be criticised and condemned by means of resolutions, cut motions on demands for their salaries, etc.; and it will be left to His Highness to take suitable action on such resolutions by the removal of the ministers or by ordering a change in their policies, etc., according to the circumstances of each case. There will be no distinction made between the official and non-official ministers in respect of their pay and status or the distribution of the several administrative portfolios among them. The Dewan who will be appointed by His Highness and hold office at his pleasure will preside over the Council of ministers. He will not be a member of the Legislative Council but can attend meetings of the Council and address it, if he wishes to do so at any time.

5. I have described above only the main features of the new Constitution and have, for want of space, left out the minor items. These important features may be briefly summarised as follows:—

(1) Though there will be two constitutional bodies—the Representative Assembly and Legislative Council, the legislature will not be bicameral as the functions of the two bodies will be different.

(2) The Legislative Council will have a preponderating majority of elected non-official members who will thus have an effective voice in its decisions. It will have an elected President and Deputy President, elected from among its own non-official members.

(3) The elected representatives of the people on the Representative Assembly and Legislative Council will be actively associated with and made to share the responsibility for the administration by the appointment of *at least* two of them (it may be more or even all in course of time) as ministers.

(4) There will be no system of diarchy with its division of reserve and transferred subjects. All the ministers—whether official or non-official—will have equal powers and status and equal chances of holding the portfolio of any department.

(5) Though the ministers will be non-removable by a vote of no-confidence by the Council, their actions and policies will be subject to criticism and condemnation by the Council which will have a large elected non-official majority. They will therefore be practically responsible to the Council, subject, however, to their control by and responsibility to His Highness the Maharaja.

It may be safely said that the new Constitution which may be expected to be brought to effect within the next few months is far in advance of that of any of the other Indian States and that it will practically inaugurate a form of "Responsible Government under the ægis of the Maharaja" for which the Congress party in the State has been agitating for some time.

K. R. SRINIVASIENGAR.

RAILWAY DEVELOPMENT IN THE STATE

General

THE length of Mysore State Railway is 748·19 miles made up of:

9·88 miles of Broad (5′–6″) Gauge, (Kolar Gold Fields Railway) worked by M. & S.M. Ry. Co.
599·91 miles of Metre (3′–3⅜″) Gauge.
102·20 miles of Narrow (2′–6″) Gauge, and
36·20 miles of Tramways (2′–0″ Gauge).

The capital outlay is Rs. 673·70 lakhs, including Rs. 33·23 lakhs, provided by the District Board of Mysore for Nanjangud-Chamarajanagar Railway (22 miles) and Kolar District Board and the Bangalore–Chikballapur Light Railway Co., for 2′–6″ Gauge Railway (93 miles).

Railway Construction in the State.— During the great famine of 1877–78, the construction of the Mysore–Bangalore section (86·01 miles) was taken up and the line was opened for traffic in 1881–82. Bangalore–Gubbi section (53·73 miles) was next opened for traffic in 1884. Both these lines were constructed by State Agency under the supervision of European engineers, and worked by the State Railway Department.

Further construction work was interrupted owing to financial pressure chiefly brought on by the Famine Debt of Rs. 80 lakhs. Then, on the advice of the Government of India, the State Railway (140 miles) was hypothecated to the late Southern Mahratta Railway Company, for a sterling loan of £1,200,000. This amount was utilised partly in liquidating the Famine Debt to the Government of India, and partly for the construction of the Gubbi-Harihar section, by the agency of the same Southern Mahratta Railway Company. Simultaneously the working of the entire State Railway was also entrusted to the Company under a contract entered into by the Secretary of State on behalf of the Mysore Government for a period of 45 years, i.e., to terminate in 1932.

In 1891, 15·04 miles of railway were constructed from Mysore to Nanjangud out of State funds by the Southern Mahratta Railway Company and opened for traffic.

Between 1892 and 1899, the following lines were built by the State Railway Construction Department, and afterwards made over to the Southern Mahratta Railway Company for working, along with the completed Gubbi-Harihar section under different contracts.

	Miles
1. Bangalore–Hindupur line, Metre Gauge (year of opening 1892–93)	51·19
2. Kolar Gold Fields Railway, Broad Gauge (year of opening 1894)	9·88
3. Birur–Shimoga Railway, Metre Gauge (year of opening 1899)	37·92
4. Nanjangud to Nanjangud Town, Metre Gauge (year of opening 1899)	0·76

In 1907, the Southern Mahratta Railway Company ceased to exist as it transformed itself into a new Company—the present Madras and Southern Mahratta Railway Company. The working of the Mysore State Lines was also transferred to this Company by the Secretary of State, under another contract entered into by him on behalf of the Mysore Government terminable in 1937 or five years later than the previous contract.

This was at a time when there was no independent State Railway Department in Mysore to take over the working of the Railways.

In 1912, a new State Railway Department was organised and a vigorous programme of construction work started. By 1918, the following new lines were completed and worked directly by the State:—

	Miles
Metre Gauge (3′–3⅜″)	
Mysore–Arsikere Railway (completed 1918)	102·95
Narrow Gauge (2′–6″)	
Bowringpet–Chikballapur Railway, partly financed by the Kolar District Board and partly by Government (completed 1916)	63·57
Chikballapur–Bangalore City, partly financed by Bangalore–Chikballapur Light Railway Company and partly by the State (completed 1918) ..	38·63
Tramways (2′–0″)	
Tarikere–Narasimharajapura (completed 1917) ..	26·60
TOTAL ..	231·75

With the opening of these new lines, efforts were made to get back for direct working, the lines previously leased to the

Madras and Southern Mahratta Railway Company. By negotiations with the Company and the good offices of the Secretary of State for India, it was possible to resume, in October 1919, the working of the two branch lines, Birur-Shimoga and Mysore-Nanjangud, and the section between Mysore and Bangalore.

To 371·50 miles of Railway directly managed by the State on 1st October 1919, the following new lines were afterwards added:—

	Miles
Metre Gauge (3′–3⅜″)	
Chickjajur–Chitaldrug. (This was financed by the State and completed in 1921) ..	20·90
Then came the Nanjangud–Chamarajanagar Railway, financed by the Mysore District Board and built in 1926	22·29
Shimoga–Anandapuram. Completed in 1934	35·95
Anandapuram–Sagara. Completed in 1938	16·33
Tramways (2′–0″)	
Tadasa–Hebbe. Completed in 1921. (This was financed by the State)	9·60
TOTAL ..	105·07

Thus, the total open mileage of the State Railway system comes to 748·19 miles, on 30th June 1940, as per particulars with cost given below.

The construction of the line from Sagara to Talaguppe, a distance of 9·43 miles, has since been undertaken and the line is expected to be opened for traffic by the end of October 1940. This brings the world-famous Jog Falls within a distance of 10 miles from the Railway terminus.

Organisation of the Department.—The General Manager is the Head of the Railway Administration and is assisted by a Personal Assistant in Office. There are six Departments in the Railway, each under a separate head, *viz.*, Engineering, Traffic, Motive Power (Loco), Stores, Medical and Audit. All the departments are under the direct control of the General Manager, except Audit, which is under the Administrative control of the Comptroller. The Auditor has three functions, *viz.*, (1) Independent Auditor, (2) Chief Accounts Officer and (3) Financial Adviser to the Administration. For purposes of working,

MILEAGE AND COST

	Miles		Capital cost Rs. in lakhs.
1. Lines worked by the Madras and Southern Mahratta Railway Company—			
Kolar Gold Fields Railway (Broad Gauge) ..	9·88		12·38
2. Lines worked by the State—			
Metre Gauge (3′–3⅜″)			
Bangalore-Harihar	210·49		
Yesvantpur-Hindupur	51·19		
Bangalore-Mysore	86·01		
Mysore-Chamarajanagar	38·09		
Mysore-Arsikere	102·95		
Birur-Anandapuram	73·95		
Anandapuram-Sagara	16·33		
Chickjajur-Chitaldrug	20·90		
		599·91	603·02
Narrow Gauge (2′–6″)			
Bangalore-Bowringpet		102·20	45·16
Tramways (2′–0″)			
Tarikere-Narasimharajapura ..	26·60		
Tadasa-Hebbe	9·60		
		36·20	13·14
		738·31	661·32
GRAND TOTAL ..		748·19	673·70

Note.—The gross earnings of the Railway were Rs. 85 lakhs for 1939–40 and net earnings nearly Rs. 29 lakhs.

the Engineering and Traffic Departments have been divided into two districts, with headquarters at Bangalore and Mysore.

Development since 1926.—Apart from the rapid extension of the Railway lines in the State since 1926, certain steps have been taken to strengthen the relationship between the public and the Railway Administration, the important one being the formation of the Advisory Committee in 1929, consisting of the General Manager as the Chairman, the Traffic Manager, the Presidents of the District Boards, an elected representative of the Chamber of Commerce and a representative of Women's interests, as members. The Committee meets every quarter to consider matters relating to facilities to the travelling public and the development of merchandise traffic.

With the resumption, on 1st January 1938, of the Bangalore-Harihar and Yesvantpur-Hindupur sections worked by the M. & S.M. Railway, the Mysore State Railway has transformed itself into a Class I Railway. Foreseeing the increased demand for outturn and production in the workshops, the scheme of Expansion of the Workshops was started in 1933–34 at a total estimated cost of Rs. 12 lakhs and was almost completed by the close of 1938.

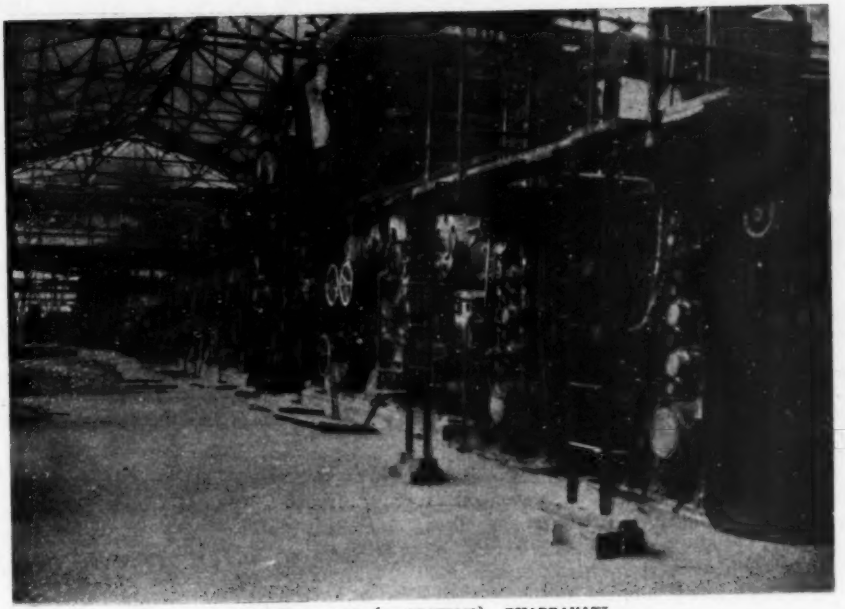
With a view to popularising the use of the Railway by the public, the rates and fares were reduced greatly from 1st July 1937 on the original lines, and from 1st January 1938 on the resumed lines. Intermediate halts have been provided on most of the sections of the Railway, where Shuttle trains stop for the convenience of the villages nearby. The increased popularity of Railway travel is shown by the fact that a greater number of trains has had to be introduced to meet the traffic requirements.

The Railway has also maintained since 1st January 1936, an auxiliary service of road buses plying between Shimoga and Sagara under monopoly obtained for the service. Arrangements have also been made to run additional buses from Sagara right up to the Travellers' Bungalow at Jog Falls during the season from November to May.

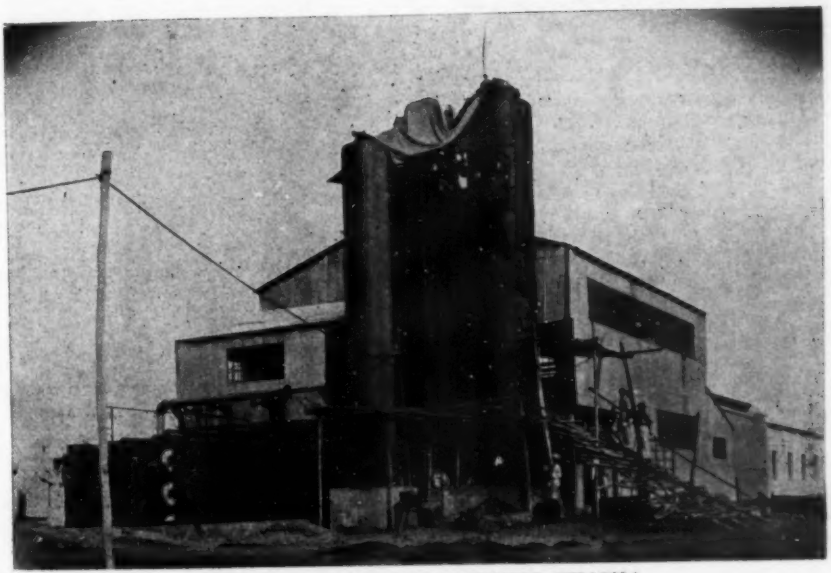
Among the many facilities provided for the travelling public may be mentioned the larger waiting accommodation at stations, electrification of stations where power is available, construction of suitable Retiring Rooms at important stations for use by passengers at reasonable charges, and improvements to station buildings and yards at important places.

Realising the importance of a through and direct connection between Bombay and Colombo, the Government of India have recently agreed, at the instance of the Government of Mysore, to the undertaking of a traffic survey by the South Indian Railway. One of the Traffic Officers of the Mysore State Railway will be associated with the Survey. The line when constructed, will establish direct Metre Gauge connection between the southernmost point in India and Poona and Manmad in the north.

Y. K. RAMACHANDRA RAU.



PAPER MILLS (A SECTION), BHADRAVATI



MYSORE CHEMICALS AND FERTILIZERS, BELAGOLA

SANDAL OIL FACTORY, MYSORE

GOVERNMENT SILK FACTORY, MYSORE

TRADE AND COMMERCE IN MYSORE

IT is a matter for genuine pleasure and justifiable pride to review the steady and rapid growth of Trade and Commerce in Mysore during the last twenty-five years. With an area of 29,000 square miles and centrally situated in the south of the Indian Continent, Mysore is a fairly large Province, endowed with all the choicest gifts which Nature can bestow, rich in mineral wealth and natural resources and capable of being developed into an agricultural and industrial State, which could compare very favourably with any advanced country in the East or in the West.

The people of the State were extremely fortunate in having had as their Ruler our late lamented Sovereign, His Highness Sri Krishnarajendra Wadiyar Bahadur of revered memory, whose irreparable loss last month is being mourned by all his devoted subjects. With the vision and foresight of a great Nation-builder, His late Highness laid the foundations of a well-planned policy and programme for the development of the economic potentialities of the State which has received universal encomiums. His Excellency Lord Linlithgow, the Viceroy of India, paid this glowing tribute during the State Banquet at Mysore in January of last year:

> "When we leave Mysore, we shall take away with us a picture of a city of great natural beauty embellished by Your Highness' care and an admirably governed State, the great natural resources of which have been developed by Your Highness' devoted labours of over forty years for the prosperity and happiness of your people."

The characteristic features of our trade in the important commodities can be analysed as follows. Amongst articles of food, Ragi, the staple crop, has an acreage of 22 lakhs out of the total cultivated area of 63 lakhs. All this is consumed locally. We imported pulses and grams worth Rs. 57 lakhs in 1920, which fell to Rs. 25 lakhs in 1936. In the case of Rice, there are 7 lakhs of acres under the crop, and the imports declined from Rs. 73 lakhs in 1920 to Rs. 60 lakhs in 1936. Though the imports of rice show a fall, in spite of the increase in population, there is still a great scope for increasing the yield by improved seeds and extension of cultivation under canals and tanks. The import of fresh fruits and vegetables was Rs. 16 lakhs in 1936 and the exports Rs. 32 lakhs. The State has a good export market in copra and cocoanuts, which has increased from Rs. 34 lakhs in 1915 to Rs. 48 lakhs in 1936. The export trade in Coffee, with an area of a little over 1 lakh acres, has been depending mostly on the vagaries of the international market. It went up to as high as Rs. 26 lakhs in 1923 and as low as Rs. 6½ lakhs in 1935, with an annual average of Rs. 12 lakhs.

The growth of the Sugar Industry in the State is very remarkable and significant. In 1931 with practically no export, we imported Rs. 21 lakhs of refined sugar, whereas in 1938 with a small import of Rs. 3 lakhs we exported sugar worth Rs. 57 lakhs, after meeting all the local requirements. Besides, we also exported Rs. 6 lakhs of jaggery. This has increased the area under sugarcane from 30 to 50 thousand acres, most of which is in the Irwin Canal area, where the Government Sugar Factory is situated. In the case of edible oils and oil seeds, in which we had a very small import, amounting to Rs. 27 lakhs in 1936, the exports of these were Rs. 65 lakhs in the same period. During the period from 1915 to 1936, the export of manufactured Tobacco has increased from Rs. 35 to Rs. 64 lakhs, and that of raw tobacco from Rs. 4 to Rs. 18 lakhs, while there is an appreciable decrease of imported tobacco, from Rs. 52 lakhs in 1931 to Rs. 28 lakhs in 1936, and from these figures it can easily be imagined to what extent the growth of tobacco—the improved varieties in particular—is being encouraged and what added prosperity it has brought to cultivators and manufacturers.

The trade in Cotton Yarn and Piecegoods has shown a remarkable increase during the last two decades. The imports of yarn and piecegoods have fallen from Rs. 319 lakhs in 1918 to Rs. 177 lakhs in 1936, while in the same period the exports have risen from Rs. 119 lakhs to Rs. 129 lakhs, beginning with Rs. 17 lakhs in 1915, thus indicating the great development and further scope for the textile industry in the State. From the figures for Raw Cotton, it is seen that the acreage has gone down from 155 thousand in 1917 to 85 thousand in 1937, and, with the increasing demand, the imports of raw cotton

have risen during the same period from Rs. 20 to Rs. 43 lakhs. It is high time that measures are devised for increasing the acreage with improved varieties, preferably in the vicinity of mills, as freight is a very important factor to be reckoned with, in the Textile Industry. It is gratifying to note that this question is engaging the serious attention of Government. The export of raw and waste silk has declined from Rs. 80 lakhs in 1925 to Rs. 22 lakhs in 1936, with the result that the ryot had to cut down the acreage under mulberry from the peak figure of 45 thousand acres to a bare 6 thousand in 1937. The starting of the Mysore Filature and the Spun Silk Factory has given some impetus to this dying industry, but no effort on our part, however great, will enable it to revive fully, unless there is an immediate and thorough review of the Tariff on imported silk, which is a matter for the serious consideration of the Government of India. Our exports of Woollen Druggets and Carpets and of Woollen Piecegoods, have increased from Rs. 11 lakhs in 1915 to Rs. 70 lakhs in 1936, showing thereby the vast possibilities in woollen manufactures.

In the case of Soap, while the imports have risen from Rs. 1 lakh to Rs. 14 lakhs, the exports have also risen from a bare Rs. 1,258 to Rs. 10 lakhs between 1915 and 1936.

The import of Chemicals, Explosives, Drugs and Dye-stuffs has been varying between Rs. 70 and Rs. 90 lakhs between 1931 and 1936, while the export has been Rs. 24 lakhs in 1936, thus providing increasing scope for our chemical industries. In the case of Iron and Steel, the import has been fluctuating between Rs. 32 to Rs. 79 lakhs from 1920 to 1936, while the exports have risen from Rs. 4 lakhs to Rs. 79 lakhs during the same period, with greater increases in recent months since the outbreak of the War. We have imported between 1915 and 1936 Machinery (excluding Railway Plant and Rolling Stock) valued at Rs. 978 lakhs which is an index of the growing industrial expansion in the State. In Gold Mining our annual exports have varied between Rs. 2½ to 4 crores. Summing up these figures, we find that in 1915 the grand total of the Rail-borne Import and Export trade in the State was Rs. 16 crores and 50 lakhs, which has risen to Rs. 24 crores and 62 lakhs in 1936, proving beyond doubt the increasing prosperity of the State in all directions. Figures up to 1936 have been taken, as these were the latest available. But, as a result of the industrial drive in the State in recent years and the fillip given by the present War, in which the potentialities of Mysore are being fully and advantageously utilised, we have made, and are making, still greater strides.

The progress we have achieved is in no small measure due to the fundamental policy animating the Government of His Highness the Maharaja to utilise to the fullest possible extent all the available natural resources for the development of the agricultural, industrial and mineral wealth of the State with its immediate effect in the raising of the standard of living of the people and increasing their prosperity. The production of electrical energy in an ever-increasing measure, its easy availability in all parts of the State at cheap rates, the improvement of communications both by rail and road, and the extension of the Telephone system, have greatly facilitated the growth of industries and commerce. Added to these, the Government's policy of investing its increasing revenues in irrigational, hydro-electric and industrial schemes, as well as in other nation-building projects, like Public Health, Education, Town-planning, and Water-supply, has created a "virtuous" circle of increasing investment, resulting in increasing production, trade and prosperity. The cities of Bangalore and Mysore with their vast industrial and business centres and public institutions, and the trunk road connecting them passing through growing towns and prosperous villages, provide an unique combination of rural and urban prosperity—an indication of the agricultural, commercial and industrial activities of the State—and are living monuments of the great work of our late Sovereign and his trusted Dewan, Sir Mirza Ismail.

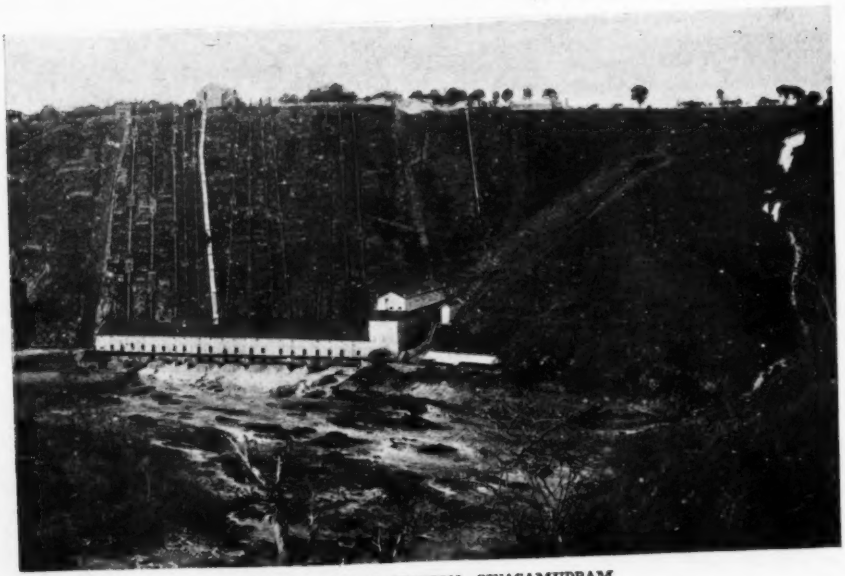
The Mysore Chamber of Commerce, started in 1916, has rendered yeoman service to the commercial community of Mysore. The Bank of Mysore, started with Government patronage, has given the lead for the sound financing of industries and commerce, and its work in the last quarter of a century has been remarkable. The proximity of the Indian Institute of Science has in many ways helped in carrying out chemical and industrial research. Government have also provided ample opportunities for the close association of officials and non-officials to plan out and participate in all these developments.

We, in Mysore, owe a deep debt of gratitude to the great administrators, Sir K. Seshadri Iyer, Sir M. Visvesvaraya and Sir Mirza Ismail, who have contributed very largely to the remarkable progress achieved so far, with their sole ideal of loyal and devoted service to their Royal Master, the State and its people.

We are fully confident that our Sovereign His Highness Sri Jaya Chamaraja Wadiyar Bahadur, with his liberal education and broad outlook, will keep up the high traditions of Mysore as a 'Model State', fulfilling the noble mission of his illustrious uncle, so inspiringly expressed by him sixteen years ago, "We in Mysore form, as it were, a nation within a nation. While co-operating with both the Indian Government and the rest of the Indian public in measures which lead to the prosperity of the country as a whole, we in our local sphere should promote education and economic growth to the fullest extent permitted by our resources."

DEVARAO SHIVARAM.

FOREST RESEARCH LABORATORY, BANGALORE



HYDRO-ELECTRIC STATION, SIVASAMUDRAM

REVIEWS

The Tools of the Chemist. By Ernest Child. (Reinhold Publishing Corporation, New York; Chapman & Hall, London), 1940. Pp. 220. Price 21*sh.*

This book outlines a branch of historical research which has not hitherto received adequate attention. It is a very successful attempt to trace the birth and growth of the chemical apparatus industry in the United States.

Students of eighteenth and early nineteenth century chemistry must always feel amazement at the skill and ingenuity with which its exponents devised and utilised appliances which appear so clumsy to us; but it is doubtful whether this emotion has engendered an appropriate gratitude towards the modern apparatus-producer. Among a hundred chemists able to describe the researches of Gay-Lussac, how many are aware that he founded with Collardeau a firm for manufacturing the apparatus he invented? How many could focus Frederick Accum, one of the early dealers in apparatus, who designed and improved philosophical "glasses", and emulated Sir Humphry Davy as a chemistry propagandist? Yet our obligation to the mute, inglorious glass-blower is incalculable.

Mr. Child's book is in three parts, namely, People and events in American Chemistry, Ancestry and development of American chemical apparatus, and Distributors of laboratory apparatus. Upwards of 100 illustrations including portraits enliven the pages, and the enterprise, which must have involved enormous labour here condensed within a narrow compass is timely because each year now unhappily removes diminishing survivors from the more secluded fields of inquiry. It assembles an extended series of events which blend into a most interesting picture; but many of which, being individually unimpressive, might otherwise have been submerged in the course of twenty years.

The Massachusetts Historical Society possesses an invoice dated March 1633, recording import of apparatus and chemicals by John Winthrop, Jr., who set up the first laboratory in the United States. He was the eldest son of the famous pilgrim father who reached Salem, Mass., in June 1630, having been appointed the first governor of the colony in the previous October; the name of their home in England, Groton, lives in five New England States, and in the famous 56-year old American preparatory school which claims sixteen Roosevelts among its old boys. Winthrop's London supplier was Kirby, following whom after nearly two centuries was Accum, who from 1802 supplied Benjamin Silliman, chemistry professor at Yale. Then came Griffin, and Mr. Child reproduces a curious illustration of the billposting art as practised in 1837, advertising "Griffin's Bazaar", established in 1826. The cradle of the indigenous American laboratory-apparatus trade, however, was Philadelphia, because that city claims the first chair of chemistry (University of Pennsylvania) and the first American college of pharmacy.

Treatment of the title-subject, and the preliminary biographical survey of chemistry in the United States are very informative, and the book deserves a place in every science library. The printing, and the reproduction of illustrations are admirable. Having discovered a gap in the history of chemistry, Mr. Child has filled it most adroitly.

M. O. F.

Aircraft Engines—Vol. I. By A. W. Judge. (Chapman & Hall, Ltd., London), 1940. Pp. 380; Figs. 226. Price 15*sh.*

This book is written by a well-known writer on internal combustion engines. The information is collected from a large number of research publications on the subject and as such the book constitutes a valuable survey of the latest information available in the field. The first part of the volume contains a very interesting account, in the light of recent knowledge of the physical and chemical processes which contribute to the efficiency and output of modern engines. Combustion chamber design, turbulence, compression ratio, rate of flame travel, detonation are all expressions which arrest the attention and on which engineers are always seeking for more enlightenment. The astonishing strides made in the output per litre in recent years makes fascinating reading. Yet the author makes no attempt at going into theoretical or design details but

explains briefly and clearly general principles with a view to clarifying their practical application. Within the scope of the book, which is expected to fill in the gap between the elementary and the more advanced books on the subject, the author has very well succeeded in conveying, with the aid of a large number of diagrams, graphs and worked-out examples, the practical aspect of the working and operation of the aircraft engine. At several places he has included useful experimental data which will not only help the reader to understand the subject but will stand him in good stead in actual practice.

The present volume which is the first part of the work does not cover the whole subject, important information concerning different types of engines, their accessories, lubricating systems, etc., which does not appear in this volume will be added in the second part.

The book has appeared at a time when its subject has assumed great importance. We are sure the book will be a valuable help and guide to many technical men, students and engineers who are particularly interested in the subject.

K. ASTON.

The Calculation and Design of Electrical Apparatus. By W. Wilson. (Chapman & Hall, Ltd., London), 1940. Pp. 230; 24 diagrams. Price 16*sh.* 6*d.*

This is the second edition of a book whose author is well known as an authority on switch and control gear. Its first edition appeared in 1934 and fulfilled a long-felt need for a book dealing with the general principles of the design of a variety of apparatus such as electromagnets, solenoids, field windings, resistors, circuit breaker parts, etc., which are not generally found in books on design. The average electrical engineer has generally no occasion to design heavy electrical machinery such as generators and transformers, but will frequently have to design a resistor or issue specifications for a circuit breaker. For the average engineer therefore the book is almost indispensable.

The second edition incorporates many changes which have brought the book up to date. Most of the elementary matter has been omitted without sacrificing the clarity of the fundamental principles, and a good deal of additional information of a recent nature has been included. The greater part of the changes has been embodied within the first five chapters. The first chapter contains formulæ for the design of liquid earthing resistors. The discussion on 'sudden heating' in the second chapter is very helpful in estimating quickly the maximum temperature rise of electrical apparatus. The third chapter on 'Forces due to electric currents' gives a very clear insight into the principles involved in the mechanical design of bus bars, switch contacts, cross bars of switches, etc. In the fifth chapter due importance has been given to modern short circuit testing. Although this subject is somewhat involved, the intimate association of the author with one of the new testing stations has enabled him to present the subject in a very simple manner. An illustrative example has been fully worked out taking a twelve element oscillogram. In view of the rather advanced nature of this subject, it would appear more logical to place the fifth chapter and the eighth chapter dealing with 'Calculation of heavy conductors' together at the end of the book.

The book abounds in numerous tables of useful data and worked examples. A set of further examples with answers has been added at the end of each chapter.

From all points of view the book will be a useful addition to one's technical library.

K. ASTON.

Thermodynamics for Chemical Engineers. By H. C. Weber. (Chapman & Hall, London; John Wiley & Sons, New York), 1939. Pp. vi + 264. Price 19*sh.* 6*d.*

The laws of thermodynamics are distinguished by the fact that they are based largely on experience. What then is more natural than to expect a wide range of utility for these laws in the practical problems of engineering? These laws have further the merit that they involve no special assumptions regarding the structure of matter or mechanism of process, and require but a few co-ordinates which can, in general, be directly measured for a description of the system or process. Thermodynamics is hence an invaluable tool for the chemical engineer for predicting the properties of his materials, and for ascertaining the driving energy required for the several unit operations.

The pure chemist is largely concerned with analysis in terms of free energy and the

engineer, particularly the mechanical engineer with entropy concepts; but the chemical engineer must be familiar with both. The book under review is divided into 20 convenient chapters, each with a summary and a set of problem exercises. These latter form a significant feature of the book and bring home very clearly the practical utility of thermodynamic considerations. The subject-matter is neatly arranged in what may be called, in the language of the chemical engineer, a didactic 'flow relationship'. The chapters on fluid flow, steam engines and turbines are concise and clear. Such studies as these have in no small degree contributed to the high efficiency of modern industrial equipments.

The reviewer has little to suggest by way of criticism excepting that Chapter XIX on 'Electrochemical effects' could be amplified to advantage. The book can be strongly recommended to all students of chemical engineering and industrial chemistry.

M. A. GOVINDA RAU.

Thermodynamics and Chemistry. By F. H. Macdougall. Third edition. (John Wiley & Sons, New York; Chapman & Hall, London), 1939. Pp. viii + 491. Price 30*sh.*

This is an American publication, and is intended for advanced students. Every topic in chemistry in which thermodynamics finds an application has been dealt with in this book. In a chapter on "Mathematical apparatus" the author gives a brief treatment of line integrals and emphasizes the distinction between exact and inexact linear differential expressions. Reversible and irreversible reactions are concisely but lucidly dealt with. A very clear account of entropy and a statistical interpretation of the same are also included. Besides a discussion of fugacity, activity coefficient and the theory of strong electrolytes, there is a chapter dealing with gravitational, centrifugal and electric fields and surface tension. In the chapter dealing with the third law of thermodynamics the recent methods of calculating thermodynamic functions with the aid of quantum statistical mechanics are also introduced, stressing the fact that the results obtained by these methods furnish a check on the validity and proper interpretation of the third law. Every chapter contains problems to be worked out by the students.

The book is a comprehensive summary of the applications of thermodynamics to chemical problems and contains a very large number of thermodynamical equations covering a very wide field. As a text-book for students preparing for an examination it can certainly be recommended. It is essentially a book on thermodynamics as applied to physical chemistry. It is not a book on physical chemistry treated thermodynamically; perhaps it was never intended to be.

M. R. N.

Electrocapillarity. By J. A. V. Butler. (Methuen & Co., Ltd., London), 1940. Pp. 208. Price 12*s.* 6*d.* net.

The book, as the author writes in the preface, "deals with potential differences at electrified interface, the origin and nature of the effects that arise therefrom, and with electrode equilibria and kinetics". Although limited in its scope, it touches upon subjects which are not dealt with in a single book. The value of the book is further enhanced by the fact that the author has himself made valuable contributions to the subject. The book opens with a chapter on the seat of the electromotive force in the galvanic cell, which contains a short historical account of the earlier work and views. This is followed by chapters on Thermodynamics of electrode potentials, the mechanism of a reversible electrode potential, electrode double layers, electro-kinetic phenomena, overvoltage, concentration polarisation and some electrode processes. The apparatus of Svedberg and Tiselius for determining cataphoretic mobility, which has been improved and used with great success by Tiselius in the study of the mobilities of proteins has been described in some detail in the chapter on electro-kinetic phenomena. The theories of overvoltage and the passivity of metals are also fully discussed. Each chapter is an excellent summary of the recent work and contains references to original sources. The book is strongly recommended to those who want to obtain an up-to-date account of the Chemistry and Physics of electrode and other charged surfaces in a concise form. Students of Physics and Chemistry working for their degree examinations in the pass and honours course will derive a good deal of benefit from its study. It will also be

greatly valued by the workers in the various fields covered by it. The book is well printed. M. QURESHI.

Introductory College Chemistry. By Neil R. Gordon and William E. Trout Jr. Second Edition. (John Wiley & Sons, New York; Chapman & Hall, Ltd., London), 1940. Pp. xiii + 753. Price 21*sh.*

This is an American publication, and as is characteristic of the origin, contains matter and method of presentation which will be appreciated by all teachers of chemistry. After an introductory chapter on manipulations, metric system and use of the balance, the author starts with water for physical and chemical studies, from which oxygen and hydrogen follow naturally. Properties of gases and fundamental laws of chemistry are treated next, then the atmosphere which leads to the study of nitrogen and its compounds. After this come acids, bases and salts. Theories of ionization are presented quite early, so also laws of mass action and equilibrium. Oxygen-sulphur family claims precedence over the halogens. After the classification of elements carbon and nitrogen families are discussed.

Part II deals with metals, the order followed being analytical groupings: alkalies, alkaline earths, the ammonium sulphide group, the hydrogen sulphide group and the HCl group. The last chapter deals with elements not covered in the previous sections, *e.g.*, the rare earths, the titanium family, vanadium and the inert gases.

Experiments which the students themselves may perform are interspersed throughout. Diagrams of industrial processes and photographic reproductions of factories are other features, as also photographs of eminent chemists. Being a modern book, the structure of atoms and nuclei and the concept of valency from the electronic point of view are all discussed. Reduction, for example, is "electronisation", and oxidation is to be termed "de-electronization".

The book aims at a new approach to the study of chemistry and is based upon what is called the "project method" of instruction. Many of the "tabloid" facts of chemistry as described in ordinary text-books are replaced by experiments which the student himself performs, and by means of questions and incomplete equations to be answered and completed by him, he is led on from the familiar to the less familiar chemical reactions. The student is provoked to think for himself and otherwise trained to depend upon himself and to do his own study without much extraneous help.

This is an admirable plan. But the reviewer doubts if it can be adopted in any school or college in India, firstly due to red-tapism which will not permit of any educational experiment in an isolated institution even with an enterprising teacher, secondly due to the paucity of proper teachers—It may be a paradox but nevertheless true that the success of this project method by which the student is trained to do his own study without extraneous help depends very much on the teacher—.Then there is the time factor. The method may not permit of so much time to be devoted to only one of the many subjects which a student has to learn for his examinations.

The book can be recommended to Intermediate students. As extra reading it can be read with profit by senior students also. All teachers will find the book very helpful in teaching chemistry and they should be familiar with the new method of instruction.

M. R. N.

Elementary Crystallography. By John W. Evans and George M. Davies. Second edition. (Thomas Murby & Co., London), 1940. Pp. 149. Price 6*sh.* 6*d.*

This is the second edition of a well-written elementary text-book on Crystallography, first published in February 1924. The present edition remains practically the same as the first, with a chapter on X-rays now added on.

It consists of sixteen chapters,—the first three are devoted to a study of the nature of crystals, their symmetry and their axial characters; the fourth and the fifth deal with the systems of notation, the zonal characters of crystals, the goniometers, some simple calculations and crystal projections; in chapters 6–13 are described all the holohedral forms of the six systems, with, in two cases, the cubic and the hexagonal, also the hemihedrons; and in chapters 14–16 are taken up the study of twins, the thirty-two classes of symmetry and the investigation of crystals by X-ray.

In the Indian Universities, where crystallography is taught as a minor part of the syllabus in Geology, it may be difficult to

use this book exclusively as an elementary text-book on the subject. The introduction in the first chapter, of the Space-lattice theory, for the definition of a crystal; the free use in the second chapter, of hemihedral form-names like Trigonial Pyramids and Trapezohedra for illustrating the symmetry of Quartz; and the enumeration in the same chapter of the thirty-two classes of symmetry; and the introduction in the third chapter, of the Weiss-Miller controversy for the indexing of the lateral axes, are sufficient surprises for a student of the Intermediate to take kindly to the rest of the book. On the other hand, a student going up for the B.Sc. Pass Degree in Geology, finds early chapters like four and five dealing with Zonal relationships, the Zone-control equation, the rule of three-faces in a zone, the reflecting goniometers (the two-circle included), and the Stereographic and Gnomonic projections,—all of which are not in his syllabus. He will, however, find chapters 6–16 easily readable,—the forms of the several systems are described on symmetry considerations, their axial characters clearly enumerated and the several faces of the individual forms described in elaborate lists, embodying appropriate algebraic signs. Yet the student will find, in the treatment of the subject, some departure from other writers of elementary text-books on Crystallography, like Bayley and Williams. The Hemihedrons of the Cubic and the Hexagonal systems alone are described; and they are described on symmetry considerations, while other writers derive first, the kinds of hemihedrisms on the geometrical theory, and thereafter describe the forms. The treatment of twinning into several kinds, is again based on the presence or absence of certain elements of symmetry, whereas other writers treat them on geometrical considerations. The last two chapters on the thirty-two classes of symmetry and X-ray study of crystals give a very concise and clear account; they afford excellent reading.

The authors have throughout the book kept the symmetry treatment prominent, and have endeavoured to give to the modestly ambitious scholar, geologist, physicist or chemist, the latest and most accurate knowledge of the subject consistent with a simple treatment. When they define parameters "as *units* of measurement on the different axes", and indices as "parameters divided by intercepts", we are encountering definitions different from the familiar ones. Again, when we notice their regret that in the Monoclinic system, it is now too late to substitute the ortho-axis for the c-axis, and the terms acute and obtuse for positive and negative hemi-pyramids respectively, or, their teaching, that in the triclinic system, each mineral has its conventional crystal-setting, we are mildly reminded of a slightly advanced knowledge.

The Honours student in India might be tempted to look into chapters four, five, fifteen and sixteen for a preliminary account of some of the material he is interested in, but, as the authors themselves remark, he would prefer to take up, even for a first reading, the well-known treatises of Mr. T. V. Barker, Professor Lewis and Doctor Tutton.

For a lecturer in Crystallography to the Intermediate and the Pass Degree in India, who is not a specialist, here is a brilliant Revision text-book from Doctor Evans and his colleague, which has the same relationship to other elementary text-books on Crystallography, as that other book of Doctor Evans, *Determination of Minerals under the Microscope*, has to H. G. Smith's *Minerals under the Microscope*,—the one for the teacher and the other for the student.

P. R. J. NAIDU.

A Text-Book of Zoology. By T. J. Parker and W. A. Haswell. Sixth Edition. Vol. I. Revised by Otto Lowenstein. (Macmillan & Co., Ltd., London), 1940. Pp. xxxii + 770. Price 36*sh.*

In spite of the original assertion of the authors, we consider "Parker & Haswell" not a book for the beginner. The inductive type of treatment of the subject is probably the only plea for its being considered a beginner's book. Zoology can be taught by two accepted methods. One is the so-called type method involving the description of one representative form after another; the other is the comparative method laying greater stress on the organ and comparing it with the same or similar organ in other groups of animals. Each method has its drawbacks and its advantages, and while the first method is more convenient the second is more comprehensive.

As the original preface admits, the type treatment followed in "Parker & Haswell"

has a particular danger to the young student, who is apt in his own fashion to generalise and to treat the type as the class,—a danger which is considerable in regard to the Invertebrata and which varies in intensity in the different phyla. We grant that the type system followed here is the most suitable to the beginner but it is also dangerous only to the beginner. It is harmless to the advanced student who is chiefly concerned with the general characters of the class he intends to study and who is as interested in the variations from the type as in the type itself. The type system is more dangerous, at least less advantageous, in regard to the invertebrates. It is unfortunate that they do not lend themselves to the construction of a regular evolutionary series as the vertebrates do and any book on invertebrates is bound to include inconclusive statements regarding the relationships and affinities of certain phyla.

It is now nineteen years since the textbook was revised and there is no doubt that a prodigious amount of work has been done during this period, work which has much bearing on the phylogeny of practically every group included in the book; so that the decision to omit all diagrammatic representations of phylogenetic relationships, is a wise one. They would at best represent a single view and would certainly introduce confusion.

The first section on the general structure and physiology of animals is of great importance and acts as an excellent introduction to the book, familiarising the student with the many technical terms that are in store for him during his study of the science and acting as a "comprehensive glossary of fundamental morphological terms which in later parts of the book, are used without further explanation". This section has been largely rewritten and has been illustrated with diagrams nearly all of which are new.

The revision of the rest of the text consists mainly in two points: first, in a rearrangement of the different phyla, with the clear warning that any such regrouping is largely a matter of convenience rather than an implied relationship. Thus the inclusion of Bryozoa (Ectoprocta), Phoronida, Brachiopoda and Chætognatha in Section X has no more phylogenetic significance than the inclusion of Nematoda, Nematomorpha, Acanthocephala, Rotifera and Calyssozoa (Endoprocta) in Section XI. The relegation of the Mollusca to the end of Vol. I in the previous editions created, however unintended, the wrong impression that they were the most nearly related among the invertebrates to the Chordata. This, we are glad to notice, has been corrected and the Echinoderma occupy, rightly, the last section of the volume.

The second important feature of the present revised edition lies in the incorporation of newer and more recent schemes of classification of the phyla.

Finally the illustrations: nearly 150 of them are either replacements of old ones or are completely new figures, and many of these are in black and white, which forms an added advantage both to the student and to the teacher.

"Parker and Haswell" occupies an unique place among text-books of Zoology and unaffected by the numerous later English publications both in England and America, it will continue to maintain its position. The revised edition forms yet another landmark in Zoological publication and will help popularize the study of this "noble science" to the English knowing students of the world.

B. R. S.

Lectures on Malaria. By Lt.-Col. G. Covell, I.M.S. Health Bulletin No. 5. (Manager of Publications, Delhi), 1940. Pp. 33. Price Annas 5 or 6*d*.

It is surprising to see what ignorance there is to-day, even in educated and intelligent circles, as to the basic principles of Malaria transmission and its control, and that about a disease which quietly and almost imperceptibly takes a toll of over one million lives every year in India, besides incapacitating or lessening the efficiency of many millions of others. There is nothing dramatic about this disease. People do not fall down dead in street corners. There is not that terror which an epidemic of cholera or plague generally rakes up. It is a slow devitalising disease, but unlike tuberculosis, another dreaded disease, can be cured by simple and effective remedies and the percentage of fatality can be rendered comparatively low. Hence the general apathy and ignorance is deplorable.

How much of knowledge should laymen be expected to possess about this disease and how far it will help them to combat it is a moot question. Generally speaking

an individual by himself can do very little to prevent the spread of Malaria, except perhaps by protecting or curing himself. But the case is entirely different regarding laymen such as engineers, forest officers, civil servants, military, railway and plantation officers, whose duties constantly bring them into contact with the disease. A clear appreciation of Malaria problems by them may go far to mitigate its ravages, or in many cases even to prevent it. A small but very interesting example may be quoted. In 1926 Lt.-Col. Covell visited the Andamans and found a certain non-malarious village, about a mile from a salt water swamp. He studied the situation and found that between the village and the swamp was a belt of dense forest composed of high trees and pointed out that this should on no account be cut down. "A few years later an enthusiastic new Commissioner visited the village and had a broad gap cut through the belt of the forest to allow the villagers to get the benefit of the sea breeze. The result was a severe outbreak of malaria due to an invasion of the village by *Anopheles sundaicus*"! Malariology, all over the world, can point to innumerable examples such as this, of well-meant but unintelligent interference with nature by executives, resulting in disastrous consequences. One has only to study the post-history of many of the recent magnificent irrigation projects in India to appreciate the force of this point. The construction of New Delhi is another excellent example and to quote Lt.-Col. Covell, in this regard:—

> "As the result of the prevalence of mosquitoes and malaria it has now been found necessary to spend a sum of approximately Rs. 2,500,000 (£187,500) on anti-malaria works, many of which have been designed to correct conditions which should never have arisen. About half of these works have been completed but the remainder are at present indefinitely postponed owing to lack of funds. Had the necessary antimalaria work been carried out as an integral part of the construction of the new capital, it would have been done at a very much lower cost."

How different things might have been if the great builders of irrigation projects and cities had a little appreciation of the tremendous power of the insignificant mosquito. Truly, to quote another distinguished malariologist, "A colossus stumbling over a gnat".

In the pamphlet under review the author has very successfully gathered such information as may be useful to lay executives in the form of eight well-arranged lectures, dealing concisely with the history, epidemiology and control of malaria. Emphasis has been clearly laid on the point that a Malaria Control Scheme, however small or big, must be investigated and directed by a competent trained malariologist. It is a very special branch of preventive medicine, which even distinguished surgeons or physicians may not fully comprehend. Moreover, the great necessity for executives to consult malariologists, before embarking upon projects which interfere to any degree with the balance of nature has been well stressed. This is a small pamphlet but is crammed with information and is very readable. We wish that arrangements could be made to place it in the hands of every executive in India, official or non-official. T. R. R.

---

1. **How to do a Malaria Survey**. By S. R. Christophers, J. A. Sinton and G. Covell: Fourth edition by Lt.-Col. G. Covell, I.M.S. Health Bulletin No. 14. (Manager of Publications, Delhi), 1939. Pp. 208. Price Rs. 1–12–0 or 2*sh*. 6*d*.

2. **Instructions for Collecting and Forwarding Mosquitoes**. Revised 3rd edition. By Dr. I. M. Puri. Health Bulletin No. 13. (Manager of Publications, Delhi), 1940. Pp. 57. Price Annas 8 or 9*d*.

These books are two of the fourteen bulletins issued by the Malaria Institute of India (formerly Malaria Survey of India) dealing with several aspects of malaria research and which are in constant use by malaria workers in India and neighbouring countries. The first of these two has now become a standard work on the technique of malaria surveys and the present edition is in bulk the same as the previous edition, a notable inclusion in the present one being a description of the modern Barber and Rice's technique of precipitin tests to determine the blood meal of mosquitoes.

The second of the two volumes is the third edition of the very useful publication dealing with the technique of handling of mosquitoes. Dr. Puri has thoroughly revised it and has presented an excellent handbook.

Both the above publications provide their own testimony of usefulness by coming out

in their fourth and third editions respectively. The instructions, mainly directed to Health and Medical Officers who take up malaria studies, are very clear and full.

T. R. R.

German-English Science Dictionary. By Louis De Vries. (McGraw-Hill Book Company, London), 1939. Pp. x + 473. Price 18*sh.*

The advancement of science in recent years has been proceeding in borderland fields where the fundamentals of two or more sciences operate. This interplay of knowledge, which had led to spectacular results, is destined to yield a richer harvest as the whole band of devoted researchers break through their watertight compartments and commence to study their problems in the light of advances made in other fields. The progressive Entomologist to-day, for example, can ill-afford to dissociate himself from the many aspects of biology; even physical sciences have been influencing the progress of entomological science.

An adequate study of German scientific literature, so essential to every research worker involves a comprehensive mastery over a wide range of vocabulary. This situation is ably met by the Dictionary which has been compiled by Professor De Vries with the active collaboration of the members of the Graduate Faculty. It is a volume which will prove extremely useful to a large circle of research workers in fields of agricultural, biological and physical sciences.

M. S.

A Student's Book on Soils and Manures. By Sir E. J. Russell. Third Edition, revised and rewritten. (Messrs. Macmillan & Co., Ltd., London), 1940. Pp. viii + 296. Price 8*sh.* 6*d.*

Sir E. John Russell, the Director of the Rothamsted Experiment Station, has brought out a third edition of *A Student's Book on Soils and Manures.* The second edition was in the year 1919. The present volume is revised and re-written incorporating the practical aspects of the progress that has been made in the intervening years between the second edition and now. Although the book is of an elementary nature written for students, and deals with British agriculture and crops, it will be useful to students outside Great Britain as an introduction to the general principles of soil management and crop growth.

B. V. N.

Annual Review of Biochemical and Allied Research in India, Vol. 10. (Society of Biological Chemists, India), 1939. Pp. 168. Price Rs. 3 or 6*sh.*

The report attempts at being a faithful record of the activities of Indian workers in a field considered biochemical. Almost all the contributors draw attention to the increasing quantity of work done in the local branches dealt with. For the new information it contains, one is nearly tempted to regard this volume as an appendix to that authoritative, annual world review of biochemistry edited by Harold Murray Luck.

The task of reviewing the work in the several branches has been performed by the respective experts attached to representative institutions in the country. To mention only a few, review on food and nutrition comes from the Nutritional Research Laboratory, Coonoor, Animal and Dairy Science from the Imperial Institute of Animal Husbandry, Bangalore, that on Pharmacology is contributed from the Haffkine Institute, Bombay, while we get an account on soils, fertilisers and manures from the Indian Institute of Science, Bangalore.

The Society of Biological Chemists has been regular in presenting these annual reports successively for these ten years now. A modest achievement, but a rich experience, yet the present volume betrays indulgent editing. Not the least among its impositions is an infectious repetition of themes.

M. S.

Statistical Year-book (1346 *Fasli* or 1937 A.D.). By Marhar Hussain. (Government Press, Hyderabad), 1939. Pp. 966. Price Rs. 5.

This is an yearly publication of the Government of H. E. H. Nizam's Government. It contains detailed statistical information about every department of the Government such as Revenue, Excise, Education, etc. The publication is a very useful one.

K. V.

WAVE-LENGTH TABLES

M. I. T. Wave-Length Tables. Compiled under the direction of G. R. Harrison. (John Wiley & Sons, Inc., N.Y.; Chapman & Hall, London), 1939. Pp. xxviii + 429. Price 90*sh.*

THE enterprise of Professor G. R. Harrison and his collaborators at the Massachusetts Institute of Technology has made possible the publication of this magnificent volume containing over a hundred thousand determinations of the wave-lengths of the lines in the atomic spectra of all the known elements except five which have not so far been studied. The Table gives the wave-lengths in international Angstrom units for all except the very feeblest lines emitted by these atoms in the first two stages of ionisation and lying between 10000 and 2000 Angstrom units. To increase the usefulness of the tables in identifying lines in spectra, 1381 band heads which frequently appear on spectrograms have also been included. About three-fourths of the entries in the tables are from determinations made in the spectroscopic laboratory of the M.I.T., this tremendous output having been made possible by the use of automatic recording comparators as described in the introductory pages of the volume. The entries of wave-lengths in every case have been carefully compared with the existing determinations. An interesting feature of the tables is the very open scale of 25 steps ranging from 1 to 9000 which has been used for indicating the intensities of the lines. Such a scale gives a truer indication of the actual relative intensities of the lines than the conventional scale usually adopted.

Every possible care appears to have been taken in the preparation of the tables which are very clearly printed on thick paper of a very pleasant cream colour. The lines are listed in order of wave-length for all the elements together, the name of the elements being given as also the stage of ionisation when this has been established by arrangement of the lines in series. The intensity and the literature reference then follows.

The volume should prove most useful to all spectroscopists. C. V. RAMAN.

THE ARCHÆAN COMPLEX OF MYSORE

The Archæan Complex of Mysore. By B. Rama Rao. (Mysore Geological Department, Bulletin No. 17 with 12 plates, 4 Geological Maps and Sections), 1940. Price Rs. 1–8–0.

MYSORE forms an important part of the Indian Peninsula, and is situated in the angle where the Western and Eastern Ghat ranges converge into the Nilgiri group of hills. The western part forms a belt of mountainous country, 20–25 miles wide, passing on to the Western Ghats, while the rest of it forms a fairly flat tableland. The geology of the area is very interesting and of great importance on account of its rich mineral resources.

A regular geological survey to map the territory and to explore its mineral resources was started in 1894 with Mr. Bruce Foote, who had already considerable experience of the geology of South India, in charge of the work. Since then our knowledge of the geology of the State has been considerably enriched by the work of several eminent geologists like Dr. J. W. Evans, Dr. W. F. Smeeth, Mr. P. Sampat Iyengar and others. The Survey has issued many valuable papers in its publications from time to time.

In the present paper of 100 pages, the author has presented, in a very lucid and masterly manner, the progress of geological ideas in Mysore during the past 46 years. He has therein made a useful and satisfactory contribution to the controversy on the origin of the Dharwar Schists in Mysore by very careful and detailed observations in the field and by analysis of representative samples in the Chemical Laboratory of the Department, and has proved that a part of the Dharwar Schists really consisted of metamorphosed sediments.

The two main geological formations of Mysore are (*i*) the Dharwar Schists, and (*ii*) a Series of acid and basic rocks intrusive into them. The Dharwar formation in Mysore consists of a series of basic and acid volcanic rocks, metamorphosed sedimentary rocks as ironstones, limestones, argillites, quartzites, conglomerates and granulitic schists, and basic and ultrabasic intrusions. Foote has described the Dharwar Schists as an intensely altered sedimentary series of rocks, which, associated with contemporary lava flows and basic intrusions, are preserved now as steeply folded, elongated synclinal bands resting unconformably on a basement complex of the granitoid gneiss. When the

examination of the Kolar Schist belt was concluded, Dr. Smeeth and his co-workers came to the important conclusions (*i*) that the conglomerate bands were of an autoclastic origin, (*ii*) that the Dharwar Schists did not rest on the granites, but the granites were really intrusive into them. Thus the Dharwar Schists became the oldest geological formation of the area.

This has also been proved to be the case in several other areas, but was contested by Mr. C. S. Middlemiss, late of the Geological Survey of India.[1] This view of the Mysore Geological Survey was accepted by Sir L. L. Fermor.[2]

The metamorphosed sedimentary rocks, quartzites, conglomerates, granulites and schists containing kyanite, sillimanite, graphite, garnet, etc., were all considered by Dr. Smeeth to be of igneous origin. Although individual geologists found some evidence for their being metamorphosed sediments, practically all the Mysore geologists had, by 1915, come to the conclusion that the Dharwar crystalline schists were really igneous in origin and that the sedimentary-looking types had been produced from igneous rocks by different processes of alteration such as crushing, alteration and replacement.

It has been found that one-sixth of the area in Mysore is covered by the Dharwar Schists and the rest by the intrusive granites and gneisses. The effects of granite intrusions on such a vast scale must have affected the Dharwar sediments very much by granitisation, hybridisation, recrystallisation, etc., that these rocks now lack distinct signs of bedding and other structures of sedimentation. This aspect of the changes in the Dharwar sediments seems to have been completely overlooked by Dr. Smeeth and his associates, who advocated a theory of igneous origin even for quartzites, conglomerates and schists containing aluminous silicates. But in most of these areas, traces of current bedding and ripple marks have since been found by Rama Rao, who, from the mineral composition of these rocks containing kyanite, staurolite, sillimanite, etc., considers them to be altered sediments.

Since the publication of the "Outlines of the Geology of Mysore" by Dr. Smeeth, several new facts have been proved by Rama Rao, *e.g.*, (*i*) the Champion gneiss has been taken out of the intrusives and their origin is doubtful, and that part of the schists has been derived from the Champion gneiss as indicated by the presence of opalescent quartz in both; (*ii*) the hornblende-schists are intrusive into the chloritic-schists and do not underlie them as an older member; (*iii*) evidence for dividing the Dharwars into three divisions by two conglomerate bands in the northern parts of the State which, due to progressive metamorphism towards the south, is not very clear there, and (*iv*) the Peninsular gneiss and the Closepet granites are the only two major acid intrusives, and (*v*) the exclusion of the charnockites from the intrusives.

Besides, a detailed study of the metamorphosed argillaceous inclusions in granite, containing diopside, hypersthene, garnet, cordierite, sillimanite, etc., has enabled the author and others to establish a number of new rock types, as Bandite Series, Kodamite Series, Bidalotite Series and Sakarsanhalli Series.

A revolutionary idea advocated by the author is that the charnockites do not represent the differentiated phases of a normal plutonic magma, but have been formed by interaction between the older norite and pyroxenite and the younger intrusive Closepet granite. It is this interaction between the basic and acid igneous rocks of different ages which seem to have given rise to intermediate and acid types of charnockites.

Since Sir T. H. Holland published his paper on the Charnockite Series of India, no further detailed work has been published on these rocks of South India. It is rather inconceivable that such large masses of charnockite, as represented by the Palnis, the Nilgiris and Ceylon could be formed by the interaction of acid and basic rocks. Besides, in several parts of Africa and other regions similar petrographical provinces have been found.[3]

In conclusion a few points may be mentioned from the reviewer's point of view. Information on these would give additional value to the maps included in the Bulletin. (*i*) The Dharwar Schists have straight and sharp boundaries and it is not clear if they are fault boundaries; (*ii*) Dips in the schists would be helpful to understand the structure: (*iii*) The Dharwar sedimentaries could be shown separately from the igneous part of the formation and (*iv*) The Champion gneiss exposure has been omitted in the Kolar belt and perhaps in other areas also.

L. A. N. Iyer.

---

[1] *Proc. As. Soc. Beng.*, N. S., 1917, **13**, cxcv–ccii.
[2] *Jour. As. Soc. Beng.*, N. S. **15**, clxxii–clxxvii.
[3] A. W. Groves, *The Charnockite Series of Uganda*, *Q. J. G. S.*, **41**, 150.

RECENT CHANGES IN THE NAMES OF INDIAN GRASSES

IN a recent issue of *Blumea*[1] Dr. J. Th. Henrard, of the Rijksherbarium, Leiden, devotes some eighty pages to the nomenclature of certain species of the Gramineæ. As this journal is not readily available to workers in India, it is believed that a useful purpose will be served by making the result of Dr. Henrard's researches, in so far as they concern India and Burma, known to agrostologists in this country.

Setaria verticillata (Linn.) P. Beauv. is a well-known European species and is to be found listed in the Flora of British India. The European species differs, says Dr. Henrard, from the tropical by being densely ciliate on the hyaline margins of the leaf-sheath. Dr. Henrard says this is a very fugitive character and it is certainly absent in some sheets of the European material of this species in the Herbarium at Dehra Dun. It is very doubtful whether it is sound to differentiate between species on a fugitive character. Proceeding further, however, Dr. Henrard says that for this species we must accept the combination *Setaria adhærens* (Forsk.) Chiovenda. Forskal called his plant *Panicum adhærens* and published the name in the *"Flora Ægyptiaco-Arabica"* (1775), p. 20. In his description he only mentions the retrorsely barbed bristles below the spikelets and says nothing about the ciliate margins of sheaths. Moreover, the type of this species is not to be found in Forskal's herbarium. Hence it is by no means certain that the *Panicum adhærens* of Forskal is the tropical counterpart of the *Setaria verticillata* of Palisot de Beauvois. Stapf and Hubbard say with regard to this species in the *"Flora of Tropical Africa,"* 9, 827, that it is "a polymorphic species, the polymorphy probably not being so much due to the presence of a number of genetic strains as to the readiness with which the grass responds to varied ecological conditions". Agrostologists in India would be well advised to continue to call their plant *Setaria verticillata* P. Beauv. until stronger arguments validate a change.

Dr. Henrard next treats *Eragrostis major*, a well-known Indian species, which has recently been known as *Eragrostis cilianensis* (Allioni) Link. apud Vign. Lutat. based on the *Poa cilianensis* of Allioni. This name was accepted by most, if not all, agrostologists on account of a paper published by Hubbard in the *"Philippine Journal of Science,"* 1913, 8, No. 3, in which the author shows that the correct name of *Eragrostis major* Host. is *E. cilianensis* (All.) Link. and not *E. megastachya* (Koel.) Link. as Dr. Henrard would have us believe. Sprague and Hubbard, C. E., came to the same conclusion in *"Kew Bull.,"* 1933, 17–18.

Dr. Henrard next proceeds to make new combinations in the section *Avenastrum* of the genus *Avena* Linn. It has recently been shown by C. E. Hubbard (*Flor. Trop. Africa*, 1937, 10, 104) that the genus *Avenastrum* Jessen (*Deutschl. Gräser*, 1863, 214) is illegitimate as it was superfluous when published, Jessen having included in his genus the older valid genera *Trisetum* Pers. and *Arrhenatherum* Beauv. The species of the section *Avenastrum* of *Avena* found in Madras have been transferred to *Avenastrum* by Fischer in the *Flora of Madras*. These species have now to be transferred to the genus *Helictotrichon* Besser.

The species of the section *Avenastrum* found in India are named as follows in the *Flora of British India*: *Avena pratensis* Linn.; *Avena polyneura* Hook. f. and *Avena aspera* Munro. The first two species should be known in future as *Helictotrichon pratense* (Linn.) Pilger and *H. polyneurum* (Hook. f.) Henrard.

The other species of the Flora of British India is *Avena aspera* described by Munro in *Thwaites Enum, Pl. Zeyl.*, 1864, 372. Hook. f. has three varieties under *Avena aspera* Munro: (1) *Avena aspera* proper; (2) var. *Roylei* Hook. f.; (3) var. *parviflora* Hook. f.; and (4) var. *Schmidii* Hook. f.

The var. *Roylei of* Hook. f. had already been described as *Trisetum virescens* by Nees apud Steudel (*Syn. Pl. Glum.*, 1854, 226). The type *Trisetum virescens* Nees, Royle 137, is in the herbarium at Dehra Dun and it is undoubtedly a distinct species. The *Avena aspera* Munro, from the Khasi Hills, Sikkim and Ceylon is also a distinct species and it is very likely that var. *parviflora* will also have to be given specific rank. Henrard has already raised var. *Roylei* and var. *Schmidii* to specific rank, the former as *Helictotrichon virescens* (Nees) Henr.

The *Avena aspera* of the Flora of British India, in fact, disappears and the following emerge: *Helictotrichon virescens* (Nees) Henr.; *H. Schmidii* (Hook. f.) Henr.; *H. asperum* (Munro) Bor. The latter combination was made by the writer in *Ind. For. Rec. Bot. I.*, 3, 68. The distribution of these three is as follows: *H. asperum* (Munro) Bor., Assam, Burma; *H. Schmidii* (Hook. f.) Henr., Nilgiris; *H. virescens* (Nees) Henr., Western Himalaya. The consideration of the status of var. *parviflora* must wait for the present.

An addition to the grass flora of British India is *Cyrtococcum schmidii* (Hack.) Henr. based on *Panicum schmidii* Hack. from Thailand. It was collected by Young in the Southern Mahratha country and in North Canara fide Henrard. There are no specimens in the Dehra Herbarium. It is distinguished from other species of *Cyrtococcum* "verrucis crebris elevatis breviter piliferis obsita" according to Hackel.

[1] *Blumea*, 1940, 3, 3.

The combination *Acroceras tonkinense* (Balansa) Henrard was not made by Henrard in his paper, as he thinks, but by Hubbard, and the correct citation is *A. tonkinense* (Balansa) C. E. Hubbard apud Bor, *Ind. Forest Records* I., 3, 78. This grass appears under the name *Panicum latifolium* Linn. var. *majus* in *Flora of British India*, 7, 39.

Another Indian species, *Acroceras crassiapiculatum* (Merr.) Alston is considered by Dr. Henrard. This species is based upon *Panicum crassiapiculatum* Merril, published in 1906. It was obvious, of course, that such a common grass had been collected previcus to 1906, and Dr. Henrard says that Balansa named it in 1890 as *Panicum munroanum* Balansa. This name was, in fact, proposed for a variety of *Panicum helopus* Trin., by Munro ex Thwaites, *Enum. Pl. Zeyl.*, 1864. It seems, however, that this name was not validly published and therefore it is better to stick to the combination made by Alston for the present.

The genus *Pollinia* of the Flora of British India is now invalid and species have been distributed mainly between the genera *Microstegium* Nees and *Eulalia* O. Ktze. The well-known grass *Pollina argentea* has been transferred to *Eulalia* by Mlle. A. Camus and named *E. tristachya* (Roxb.) A. Camus, based upon *Andropogon tristachyus* Roxb., a nomen nudum in *Hortus bengalensis*, 1814, 6. *A. tristachyus* was not validly published until 1820 in *Flor. Indica*. In the meantime Humboldt, Bonpland and Kunth had published an *Andropogon tristachyus* in 1816, a circumstance which invalidates the specific epithet *tristachyus* for this grass. The next valid name for this species is that of Schultes, *A. trispicatus*, published in *Mantissa*, 1824, 2, 452. Henrard now makes the combination *Eulalia trispicata* (Schultes) Henrard. Dr. Henrard makes the following combinations for certain Indian species formerly appearing under *Pollinia*. *Microstegium eucnemis* (Nees) Henr.; *M. stapfi* (Hook f.) Henr.; *M. vagans* (Nees) Henr.; *M. delicatula* (Hook. f.) Henr.

The following combinations are made by Dr. Henrard in *Bothriochloa* O. Ktze., for species found under *Andropogon* Linn. in the Flora of British India. *B. ensiformis* (Hook. f.) Henr.; *B. concanensis* (Hook. f.) Henr.; *B. ischæmum* (Linn.) Henr; *B. foulkesii* (Hook. f.) Henr.; *B. pseudoischæmum* (Nees) Henr.

On page 305, *Flora of British India*, is to be found the species *Neyraudia madagascariensis* Hook. f., based on *Arundo madagascariensis* Kunth, and its variety *zollingeri* Hook. f., based on *Arundo reynaudiana* Kunth. These two are now considered to be distinct on account of the difference in habit and range as well as the presence of the empty lemma in the spikelet of the latter. The former should be known as *Neyraudia arundinacea* (Linn.) Henr., based on *Aristida arundinacea* Linn. The latter is known as *Neyraudia reynaudiana* (Kunth) Keng, based on *Arundo reynaudiana* Kunth. Dr. Henrard, however, remarks, "If we agree with Hooker's opinion that both names of Kunth belong to but one species" then the variety must be called *Neyraudia arundinacea* (Linn.) Henr. var. *zollingeri* (Buse) Henr. This new combination merely adds another name to the synonymy of *Neyraudia reynaudiana* (Kunth) Keng.

Finally, Dr. Henrard has examined the *Isachne kunthiana* Wight et Arn. of the Flora of British India. He remarks, "This species is described by Hooker in *Fl. British India*, p. 21, as *Isachne kunthiana* Wight et Arn. but that is a herbarium name and a nomen nudum placed by Thwaites in *Enum. Pl. Zeyl.* definitively (definitely ?) under *Isachne*, but Miquel published *Isachne kunthiana* Nees, in 1855 in his *Flor. Ind. Bot.*, III, 460." The specimen upon which the species is based was called *Panicum kunthianum* Wight et Arn. ap. Steudel, *Syn. Pl. Glum.*, 1854, 96, and a description was provided. The correct citation therefore for this species should be *Isachne kunthiana* (Wt. et Arn.) Nees ap. Miquel *loc. cit.* Dr. Henrard considers that the name quoted only applies to the plant found at low elevations. The Nilgiri plant which was included by Hook. f., *loc. cit.*, under *Isachne kunthiana*, he believes to be a distinct species, differing from *I. kunthiana* (Wt. et Arn.) Nees by its pubescent nodes and more open panicle. The Nilgiri plant was called *Panicum metzii* Hochst. in Steud. *Syn. Pl. Glum.*, 1854, 95, based on a sheet (no. 1276) in Hohenacker's herbarium. Dr. Henrard now proposes the name *Isachne metzii* (Hochst.) Henr., for this plant. This name, however, has already appeared as *I. metzii* Hochst. in the synonymy under *I. kunthiana* in the *Flora of British India*, where Hook. f. gives a reference to Hohenacker's plant No. 1276. If, therefore, the Nilgiri plant is specifically distinct from *Isachne kunthiana* (Wt. et Arn.) Nees, which in my opinion is extremely doubtful, the correct citation should be: *Isachne metzii* (Hochst.) Hook. f. in *F.B.I.*, 7, 24.

N. L. Bor.

THE MARKETING AND TRANSPORT OF JUTE IN INDIA

THE various aspects of the marketing and transport of jute in India formed the subject of an exhaustive enquiry by the *Indian Central Jute Committee* and the results of the enquiry have just been published as far as it relates to raw jute, the subject of the manufactured product being reserved for a separate publication to be issued shortly. The report deals in great detail with every aspect of the subject giving precise and authentic information supported by a mass of statistical data and illustrated by many diagrams and charts. Quite an important section describes the present methods of forecasting areas and production and the well-known imperfections of these methods are fully brought out; the official forecasts are found to fall short of actuals to an extent varying from 26 to 41 per cent. in the acreage alone, and in respect of out-turn by about 23 per cent. on the average. The recent arrangements for evolving a less unsatisfactory method of forecasting by adopting the random sampling technique is referred to in this connection which will be carried out as an experimental measure. The jute area in India may be put down as approximately 2,900,000 acres with an estimated production of about 10,000,000 bales giving an average yield of about 3 bales per acre. About 57 per cent. of the production is used in the Indian mills, and 40 per cent. is exported; the export value of both raw jute and manufactured products amounted to about Rs. 45 crores in 1937–38. The peculiar feature of the jute industry in India is that the cultivation is confined to Bengal, Bihar, Assam and Orissa; neither the other parts of India nor other countries in the world have been found suitable and the production outside India may be considered negligible giving India therefore a complete monopoly in the supply of this product. A good many substitutes have however been used in recent years and these have shut out jute from some of its accustomed markets notably Australia where it has now ceased to be used for wool packs. The Research Section of the Committee is said to be working on the subject of finding additional uses for jute.

The various steps in the marketing ladder are fully described in the publication with recommendations for minimising losses to the actual grower. It is also a singular fact that this huge production is derived from very small farmers, about 37 per cent. of growers in East Bengal and 50 per cent. in other jute areas produce less than ten maunds and those who produce over 30 maunds number only about 12 per cent. Attention is drawn to the difficulties of transport on account of the inundation to which the country is subject regularly during part of the year, and which is one of the chief reasons why growers are forced to sell the fibre quickly, indebtedness and poverty being as elsewhere other causes operating against holding up the crop in expectation of higher prices; but from the trend of prices given in the report it is seen that prices rule high during the months after harvest and then fall continuously from which one gathers there is no advantage in helping growers to hold up produce. An example of the difficulties of transport is furnished by East Bengal where 85 per cent. is by country boats, quite 10 per cent. by headloads and some 5 per cent. by carts and ponies.

The marketing intermediaries and their methods and even malpractices are very similar to what prevails with other products and form familiar reading. A bewildering multiplicity of weights and measures, frauds in weighment, various unjustifiable market charges, deductions for alleged inferiority in quality, moisture content and so on, ignorance of the price fluctuations on the part of growers, watering of the jute, adulteration with inferior grades, price fixation not by open bidding but secretly under cover,—these features characterise the jute trade quite as much as they do all agricultural marketing in this country. The remedies recommended are also more or less familiar. The organisation of regulated markets, standardised weights and measures, legislation on the lines of Cotton Transport Act, publication of daily prices in the village by suitable means including radio, improvement of rural road and other means of transport are among the suggestions made. Reference is made to co-operative sale societies but Bengal seems to have had disastrous experience of such societies; between 1925 and 1929 as many as 16 societies were formed including a wholesale society but by 1930 all of them had to be closed involving a loss of Rs. 20 lakhs! It is doubtful if in the face of this experience further ventures in this field will be viewed with favour.

The price structure compiled reveals that taking Calcutta delivered price as Rs. 100, the producer received Rs. 81, transport and handling absorbed Rs. 10, market allowances Rs. 3 and standing charges of balers Rs. 6. Although some of these charges are capable of reduction especially the market allowances and the balers' charges for being passed on to the grower, still it is evident that the grower does not get a bad deal after all, especially when it is remembered that he sells quite 75 per cent. of his produce either at his door or in nearby weekly fairs and that between 80 and 90 per cent. of the crop is sold and converted into money within three or four months after it is ready for sale.

The large terminal purchasers at Calcutta both for the mills and for export are exceedingly well organised as may be assumed in an industry of this magnitude. The *Indian Jute Mills Association* is the most important organisation and it exercises great influence in the general conduct of the jute trade. The futures market is in the hands of three Associations, their working leaves much to be desired and recommendations are made in this behalf. Among matters for research are mentioned the subject of the moisture content of raw jute, the evolving of a method of classification of qualities and grades on scientific basis and a determination of the spinning qualities of the different classes of jute. An account is given

of the frequent changes in standards fixed for the trade qualities with the attendant confusion and room for arbitrary assessment of values. Improvement in methods of preparation and storage are also among the questions being studied.

Scientific work has resulted in the evolution of high yielding strains in both the species grown, *viz.*, the *capsularis* and the *olitorius*. In 1937–38 it is said that 53 per cent. of the jute area in Bengal was cultivated with these improved strains, a very notable testimony to their superiority over the ordinary strains. Reference is made to a scheme of seed distribution which resulted, strangely enough, in the extraordinarily high price of from 12 annas to Re. 1 per seer of Government seed as against one and a half annas to two annas for bazaar seed. As a result, in that year only one per cent. of the jute area was sown with seed from Government supply. It should certainly be possible to remedy this state of affairs. Special efforts are, however, being made with suitable funds to extend the supply of improved seed. The report is a mine of valuable information, statistical and descriptive, on the various factors relating to the marketing of raw jute.

A. K. Y.

CENTENARIES

Mallet-Favre, Jaques Andre (1740–1790)

JAQUES ANDRE MALLET-FAVRE, a Swiss astronomer, was born at Geneva in September 1740. He was a favourite pupil of Daniel Bernoulli. About 1770 he became professor of astronomy at Geneva and built its observatory. He wrote seven papers, the field covered being probability, astronomy and mechanics. The first paper entitled *Recharches sur les avantages de trois joueurs, etc.*, appeared in 1762 in the *Act. Helvet.* He was a fellow of the Royal Society of London and its *Transactions* of 1767 contained his *Memoir concerning the most advantageous construction of water-wheels, etc.*, in which he investigated the most advantageous number and size of float-boards.

Mallet died at Geneva 30 January 1790.

McClintock, Emory (1840-1916)

EMORY McCLINTOCK, an American actuary, was born at Carlisle, Pa, 19 September 1840. His father was a clergyman who acted as professor of mathematics in Dickinson College for a time. While Emory was an undergraduate at Columbia, his remarkable ability excited the admiration of his professors. When one of his teachers fell ill in April 1859, he was graduated as an emergency measure and appointed tutor. But he migrated to Paris in 1860 along with his father. After studying chemistry at Gottingen, he returned to America in 1862. He was appointed as an engineer of the United States Army, but, on his way to Washington, suffered a sunstroke which prevented him from entering the army. After seeing various appointments, he finally settled down in 1889 as actuary of the Mutual Insurance Company of New York.

Contribution to Actuarial Science

McClintock's grasp of the insurance problem and his recommendations in the general reorganisation of the American life-insurance companies in 1905–1906 made him for many years the recognised leader in actuarial circles. He was one of the founders of the Actuarial Society of America (1889) and later its president (1895). He was also a member of the permanent committee of the International Congress of Actuaries.

Contributions to Mathematics

McClintock was also one of the founders of the New York Mathematical Society (1891) and one of the leaders in transforming it into the American Mathematical Society in 1894. It was chiefly through his encouragement and support that its *Bulletin* (1891) and *Transactions* (1900) were started. It was again his influence and financial assistance that led the Society to publish (1896) the *Proceedings* of the International Mathematical Congress held at Chicago in 1893. He never failed to stimulate and inspire every one of scientific aptitude with whom he came in contact.

His Papers

In addition to several contributions of actuarial nature, McClintock published no fewer than 23 papers which belonged to the domain of pure mathematics. His first paper entitled *An essay on the calculus of enlargement* (1879) was an attempt to present the calculus of finite differences and the differential calculus from a unified point of view. This paper is looked upon as a precursor of recent attempts to consider difference equations as differential equations of infinite order. His *Analysis of quintic equations* (1885) and other papers on the same subject indicate his truly remarkable power of manipulation and clearness of vision.

McClintock died 10th July 1916.

S. R. Ranganathan.

University Library,
Madras.

SCIENCE NOTES AND NEWS

Class-field Theory.—Following the brilliant work of his thesis C. Chevally has ("La theorie du corps de classes," *Annals of Mathematics*, 41, pp. 394–418) developed the class-field theory of an algebraic field K to infinite abelian extensions also. He considers the field of extension of K which includes all abelian extensions. The corresponding Galois group is infinite but as G_k is in general a topological group whose structure is that of the Cantor discontinuum, its group of characters is finite. We owe to the great Russian mathematician Pontrajin the result that an abelian group with this structure is determined completely by its group of characters and *vice versa*. Following the ideas of Hasse and Van der Waerden, Chevally gives a nice theory of the units of an algebraical field.

He considers an algebraic field K (of finite degree). If p is a prime divisor of K (same as prime-ideal if it is a finite divisor) let K_p be the corresponding p-adic field. Let $K^*(p)$ be the multiplicative group of K_p (excluding o). Then if we denote by G the direct product of all possible such groups, then each element a of G is determined by its co-ordinates L_p $CK^*(p)$. Then the subgroup of G composed of those elements L which are such that except for a finite number of p's L_p is a p-adic unity is denoted by J_k called the fundamental group of the field K. (This corresponds to the group of unbranched ideals in the classical theory.) The elements of J_k are called *idele* instead of the French term 'ideaux'. These idele as opposed to the usual ideals enable him to extend the classical theorems of class-field theory to infinite abelian extensions. Instead of the multiplicative group of principal ideals he considers an analogously defined P_k. Another important notion introduced by him is the notion of differential of an algebraical field which is the following. It is easily proved that every character of J_k is of finite order as J_k is perfect and discontinuous in its topological structure. Then a differential of K is a character of J_k which is = 1 for every element of P_k In a sense this theory corresponds to the theory of differentials in algeoraic functions. He then shows that group of characters of G_k is isomorphic with the group of differentials of k from which when we translate into the theory of the usual ideals we come to the general reciprocity theorem of Artin. The central theorem of his paper is the following.

Let K be a finite algebraic field. Then there exists an isomorphism $\chi \to \phi = \phi_k(\chi)$ of the group of characters χ of the Galois-group G_k of the complete abelian extension of K over K and the group of differentials of K. This isomorphism possesses the following properties:

1. If Ω/K is a finite extension of K then

$$\phi_{\Omega}\left[N_{\Omega/l}\ (x)\right] = N_{k/\Omega}\ \left[\phi_k\ (x)\right]$$

2. If K^τ be any congujate field

$$\phi_{k^\tau}\ (x^\tau) = \{\phi_k\ (x)^\tau\}$$

3. The prime-divisors of the ramification of χ and $\phi_k(\chi)$ are identical.

He then proves theorems analogous to those of the Hilbert-Hasse theory of finite extensions after establishing inequalities analogous to those by Takagi. K. V. I.

A Quantitative Determination of the Neutron Moment in Absolute Nuclear Magnetons.—The first determination of the magnetic moments of the proton and the deuteron by the molecular beam method was carried out by Frisch and Stern. The values obtained were $\mu_p = 2{\cdot}5$ and $\mu_d = 0{\cdot}8$ nuclear magnetons. The modification of the molecular beam method due to Rabi and his collaborators has made it possible to determine these moments more accurately as $\mu_p = 2{\cdot}785 \pm 0{\cdot}02$ and $\mu_d = 0{\cdot}855 \pm 0{\cdot}006$. The magnetic moment of the neutron was hence expected to be of the order -2 nuclear magnetons since $\mu_p + \mu_n = \mu_d$. Attempts have been previously made to determine the neutron moment by direct experiments. One method has been to study the intensity of a scattered neutron beam when the scatterer was magnetized. This method however is not of any accuracy. Another method adopted by Frisch, V. Halban and Koch was to find the change in polarisation of a neutron beam by a magnetic field. Even this method did not give accurate results. Alvarez and Bloch (*Physical Review*, 1940, 57, 111) have used a resonance method which has given accurate results. The neutrons are made to precess about a field H, say in the Z direction and then subjected to an oscillating field in the X direction $H_x = H_1 \cos(\omega t + \delta)$. Neutrons with $m = \frac{1}{2}$ have a probability P of changing over to $m = -\frac{1}{2}$ given by

$$P = \frac{\sin^2\left[\frac{\mu H_1 T}{2\hbar}\left(1 + \left\{\frac{2\Delta H}{H_1}\right\}^2\right)^{\frac{1}{2}}\right]}{\left[1 + \left(\frac{2\Delta H}{H_1}\right)^2\right]}$$

where T is the time that the neutrons spend in the field and $\Delta H = H_0 - H_0^*$ with $H_0^* = \hbar\omega/2\mu$. H_0^* is the value of the field when the Larmor frequency is equal to ω. T is different for different neutrons and so the average value of $\sin^2 = \frac{1}{2}$ can be taken. Then

$$P = \frac{1}{2}\left[1 + \left(\frac{2\Delta H}{H_1}\right)^2\right]^{-1}$$

when P is max. $\Delta H = 0$ and $H_0 = H_0^*$. If a fraction f_1^+ and f_1^- of neutrons with $m = \pm\frac{1}{2}$ pass through a plate F_1 and if a polarising plate F_1 and an analysing plate F_2 are used (magnetised in the Z direction), the total fraction transmitted $f = f_1^+ f_2^+ + f_1^- f_2^-$. If a probability P exists for m to change from $+\frac{1}{2}$ to $-\frac{1}{2}$, $f' = (1 - P)(f_1^+ f_2^+ + f_1^- f_2^-) + P(f_1^+ f_2^- + f_1^- f_2^+)$. Hence there is a change in

intensity of the beam such that

$\Delta I/I = (f' - f)/f = - c P$ where

$$a = (f_1^+ - f_2^-)(f_2^+ - f_2^-)/[f_1^+ f_2^+ + f_1^- f_2^-].$$

The maximum value of $\Delta I/I$ is found from experiments with counters filled with BF_3. It is $= -a/2$. The field H_0* at which $\Delta I/I$ is maximum is found and then $\mu = \hbar\omega/2H_0$*. To find H_0 and ω the authors use an ingenious method. They find the frequency ω_p of a field H_p which resonantly accelerates protons in a cyclotron. This is given by $\omega_p = \frac{eH_p}{Mc}$, where M is the mass of the proton.

But $\omega_n = \left(\frac{2H_n \mu_n}{\hbar} \frac{e\hbar}{2Mc}\right) = \frac{eH_n}{Mc} \mu_n$ where μ_n is in nuclear magnetons.

$$\therefore \mu_n = \frac{\omega_n}{\omega_p} \frac{H_p}{H_n} = - 1{\cdot}135 \pm 0{\cdot}002 \text{ nuclear magnetons.}$$

This value shows that $\mu_p + \mu_n = \mu_d$ within experimental error. This is rather hard to understand since for it to be true the state of the deuteron should be $3S_1$ which it is not since it has a quadrupole moment, or μ_p and μ_n must be additive without any change due to the interaction of proton and neutron.

T. S. S.

Fuel Crops in South Indian Dry Forests.—The raising of plantations in the drier regions of South India which fail to receive the full impact of either monsoon is beset with a great many difficulties—sylvicultural, economic and protective. Meanwhile, the demand for fuel from these tracts is on the increase and getting more urgent. And thus arises the great practical importance of devising suitable technique for the artificial regeneration of the dry fuel forests. It appears now that, as a result of prolonged and systematic research, this problem has at long last been solved in broad outline, although further experience might indicate minor improvements. The methods employed, the costs involved and the results that might be expected are succinctly summarised by Mr. A. L. Griffith, Provincial Sylviculturist, Madras, in "A Note on the Artificial Regeneration of the Dry Fuel Forests of the Madras Province" (Manager of Publications, Delhi, 1940, price Re. 1 and annas 14). The "rab-Kumri" method (as this system has been named) has, in the words of Mr. M. V. Laurie, the Central Sylviculturist, Dehra Dun, "the additional advantage of providing land for cultivation and employment for the poorer people living on the margins of the forest". Mr. Griffith's account of the technical details of the method while not sacrificing scientific accuracy is at the same time very readable, the more so because of the excellent photographs accompanying the text. In fact a keen forester with the aid of this Note should be able to plan an experimental plantation. But foresters as a class are conservative and it might well be that the task of converting them to these newer methods is more difficult than the success of the method would lead one to expect. Such education by demonstration is the next logical step. EMMENNAR.

Infestation of Grain by Insects.—The Department of Scientific and Industrial Research has just published a report ("Report on a Survey of the Infestation of Grain by Insects", published H. M. Stationery Office, price 1*s.* 3*d.*) on the extent to which stored grain is infested by insects. The survey which it describes was made at the request of the grain trade and with its assistance and financial support.

The report states that infestation by insects is to be found in docks, farms, merchants' premises—in fact, throughout the whole chain of transport and storage. These insects are not natives of the British Isles, but were and still are brought in with grain and other produce; and, although they cannot live and breed on British crops or corn stacks in the field, they do thrive in barns, granaries, warehouses, and mills.

After brief descriptions, illustrated with photographs and drawings, of the most important species of insects which attack grain in store and of the part played by mites, the report shows how insects, once landed at the ports, are distributed right through the country. The links in this chain of distribution, *i.e.*, dock premises, transport vehicles and containers, mills and agricultural merchants' premises, farms, breweries, and distilleries are all dealt with in turn. A diagram illustrating the movements of grain shows how home-grown grain, which is free of insects when harvested, can become infested on the farm.

While it is hard even to guess at the vast amount of damage done by these enemies which prey on the nation's food supply, the first line of defence against them is the commonsense rule of health—scrupulous cleanliness and separation of the infested from the healthy.

Obviously if the loss and inconvenience caused to industry was becoming intolerable in normal conditions it cannot be tolerated when every effort must be made to avoid waste of food supply and the publication of this report is a timely warning of the risk to be faced.

The report includes a declaration made by representatives of many sections of industry that since all concerned must share the responsibility for infestation, good commercial practice requires every section of industry to treat infestation as a "notifiable disease" and so make possible the segregation of infested goods.

Flax Cultivation in India.—A scheme for growing *flax* in India, estimated to cost Rs. 4,50,000 has been approved by the Government of India. About 1,200 acres will be sown shortly in Bihar and Bengal. The seed, purchased in Holland, has arrived in Calcutta and if germination tests are satisfactory, the necessary machinery will be ordered. The scheme includes guarantees to cultivators designed to discount the risks attendant on the growing of a new and unfamiliar crop.

The flax plant belongs to the same species as linseed, which is grown extensively in India. Some difficulty was experienced in obtaining

seed, for which there is a keen demand in the United Kingdom and Ulster.

The question of flax spinning is already under consideration by the *Indian Central Jute Committee*.

Seventy per cent. of the world's supply of flax comes from Russia. Small quantities are also produced in the United Kingdom and Ulster. Recently, however, the war demand for flax has increased enormously, particularly for the Admiralty, Defence, A.R.P. and other services.

Experiments on the cultivation of flax in India have been in progress for some years in Bihar, Bengal and the Punjab. These experiments have already shown that there is immense scope for such a venture.

The Bengal Government has been making experiments with seed brought from Ireland and grown at the Government farms at Dacca, Rangpur, Dinajpur and Berhampore.

Control of Lantana Weed by Insects.—A lantana bug which is capable of destroying lantana flowers and shoots in a spectacular manner has recently been established in Australia from Fiji and Hawaii. This bug could do useful work in India, but its introduction should be carefully supervised.

A survey carried out by the *Forest Research Institute*, Dehra Dun, showed that there are no indigenous insects that can be used to exterminate lantana in India, although some 400 species visit this weed.

The possibilities of control of lantana have been discussed in a recent publication of the Forest Research Institute. It is suggested that a concerted policy on the lantana problem by the Central and Provincial Governments should be adopted in the near future as it is not improbable that unauthorised importation might take place and this may create a problem more difficult to solve than extermination of lantana itself.

The *Annual Report* of the **Hydrodynamic Research Station, Poona**, for the year 1937–38, recently issued [*Research Publication* No. 1. (Manager of Publications, New Delhi), 1939. Pp. 85. 150 Figs. Price Rs. 7–8–0] is a very valuable document. The Station is located downstream of the Dam of Fife at Khadakavasla and was opened some 12 years ago. The Station, at present, has a length of channels and models exceeding 2,400 feet and it occupies an area of about 6 acres. Various problems relating to hydrodynamics and irrigation are referred to it for study. The results of a few experiments conducted at the Station are given below:—

To study the causes of the wide variations in the courses of rivers in Bihar, a small model of the Ganges and three of its tributaries was made. Experiments indicated that these changes were natural but the severity of those movements was heightened by the flood embankments. To determine the likely changes in the river during the next few years, experiments on a large-scale model of the Ganges above the Hardinge Bridge are in progress.

In the case of a ferry crossing, across the river Mula, rendered unsuitable by the construction of a causeway below, experiments on models with erodable banks indicated that a Burma Spur (shaped like a hockey stick pointing upstream) projecting from the convex bank deflected the main flow of the river round the bank and created satisfactory flow conditions at the crossing. The 1937 floods greatly increased the sinuosity of this part of the river and the possible utility of the extension of the existing Burma Spur was rendered doubtful. Alternative methods for diverting the main river are being tried on the model.

The shifting of river Jumna at New Delhi, away from the Delhi Gate Pumping Station and the damage done to Kaira Town on the left bank of the Watrak river during the 1937 floods are subjects of investigation on models constructed to reproduce the flow of the rivers in the vicinity and the effect on the courses of these rivers caused by the removal or extension of the existing spurs or the addition of spurs of various designs, is studied.

Silt exclusion from the Faizwah canal was indicated as possible by experiments on a modified model of Faizwah Head Regulator, ex-Khairpur West Feeder, with the channel at full supply level made to converge at 1 in 5 just upstream of the Faizwah and diverge at 1 in 10 at surface on the downstream. The modified model lowered the silt ratio to about one as against a ratio of 10 to 1 of Faizwah to Khairpur as determined by experiments on a model of the existing Faizwah Head Regulator. To study steps to be taken to reduce silting in the North Western perennial canal, experiments on a model 170 feet long of the river Indus and the Lloyd Barrage are in progress.

Afflux experiments on models of the Mula causeway at Rahuri showed that the curved bellmouth was best for low discharges, the semicircular was yielding slightly better results for high discharges. Experiments were also conducted to investigate the distribution of flow in a divergence and to test the various practical devices such as baffle type and grid type stabilisers to make the flow "fan out" satisfactorily. Work on the Silt Abrader indicated that abrasion in the boulder and pebble reaches of rivers occur mainly while the stones are at rest due to finer material passing over the stones. This is also found to be true to a large extent in the case of coarse silt. With finer silt, abrasion takes place as the sand waves move along the bed forming ripples. Experiments on a model of Burma type spur showed that it will remain stable if the nose, to which the severest attack of the diverted main flow is confined, is constructed strong enough to withstand attack.

Determination of the basic laws of downward flow above a water-table has been the subject of a series of experiments conducted to measure the seepage through columns of silt.

In connection with the protection of the Hardinge Bridge, experiments conducted to study the launching of an apron, the cause of failure of apron protection, the best design of aprons laid on sand and on alternating layers of

sand and clay and a good method of reinforcing aprons already launched, have led to valuable conclusions. The falling apron appears to be quite stable, if supplied with sufficient stones and self-adjusting to resist all possible attack.

The paper on "The use of models for elucidating flow problems" by C. C. Inglis shows how model experiments are valuable in the solution of practical engineering problems, how results of high qualitative and even of quantitative accuracy may be got from large models and how while some types of models yield results suitable for immediate application there are other types, specially those pertaining to flow in alluvial rivers, which present great practical difficulties. The paper on "The exclusion of silt from the heads of canals and distributaries" by C. C. Inglis and D. V. Joglekar stresses the importance of an approach channel taking off where the beneficial effect of curvature of flow is a maximum.

The investigations undertaken by the Research Station are undoubtedly of considerable value. The usefulness of the Hydrodynamic Research Station has been greatly appreciated and its advice on various problems is being increasingly sought. C. GOPALAKRISHNAN.

The Indian Association for the Cultivation of Science.—A brief account of the activities of the Association for the year 1939 is recorded in the *Annual Report* of the Committee of Management, just issued. The scientific work carried out in the laboratories of the Association under the inspiring guidance of Prof. K. S. Krishnan, F.R.S., is given in Appendix II of the report. The work includes the following topics: (1) The Magnetic Properties of a Free-Electron Gas, (2) The Landau Diamagnetism and its Experimental Verification, (3) The Metallic Properties of Graphite, (4) The Mobile-Electrons in Aromatic Molecules, (5) The diamagnetism of Aromatic Molecules, (6) Optical Studies on Aromatic Molecules, (7) Magnetic Studies on Bismuth in the Neighbourhood of its Melting Point, (8) Some Paramagnetic Studies, and (9) Structural Studies on Organic Crystals. Dr. S. C. Deb, D.SC., who was reappointed Research Fellow during the year, carried out a systematic study of the band spectra of the transition group of elements. In all 16 research papers were published during the year from the laboratory.

The Association continued its usual educational activities. A course of lectures in physics and chemistry was given for the benefit of the students of the Calcutta Medical School. Nine Seminar Lectures were delivered during the year. Meteorological reports were issued regularly to several local newspapers.

The Indian Journal of Physics, the official organ of the Association, continued to appear regularly during the year. Three special publications—(1) Garnets and their role in nature by Sir L. L. Fermor, (2) The Royal Botanic Gardens, Kew; Studies in the Germination of Seeds by Sir Arthur Hill and (3) Interatomic Forces by Prof. J. E. Lennard-Jones—were also issued during the year.

We note that the Government of India have been moved to enhance the annual grant from Rs. 18,000 to Rs. 27,500 so as to enable the Association to provide for additional annual expenditure. The Government of India have also been requested to sanction a non-recurring grant of Rs. 32,000 for providing hostel, library, workshop and laboratory facilities. We trust that the government will generously respond to these requests and thus assist this premier Indian Scientific Organization to finance its enhanced activities.

The Indian Research Fund Association.—The enquiries financed by the Indian Research Fund Association cover a wide field and include most of the major diseases affecting the health of the people of this country. According to the *Annual Report* for the year 1939, a sum of nearly Rs. 4,76,000 was distributed during the year in the form of grants.

At the Haffkine Institute, research work on an anti-plague vaccine with maximum protective power was in progress. A serum for the treatment of plague patients had been prepared by this Institute and had undergone limited trials with encouraging results during certain epidemic outbreaks. A considerable amount of work was carried out during the year on leprosy. It was shown that the adoption of a wheat diet by patients, affords considerable relief in respect of chronic bone and nerve pain associated with leprosy. The administration of skimmed milk to children with the more severe forms of leprosy, appears to help towards a cure.

A nutrition museum was established in the *Nutrition Research Laboratories* at Coonoor, which is maintained by the Indian Research Fund Association. Ever since it came into existence in 1911, the Association has devoted increasing attention to the study of nutritional problems and to the practical application of the results of such study to the improvement of the diet of the people. During the year 1939 some fifty surveys on the state of nutrition and the dietary habits of the people were conducted in various parts of the country. Analysis of the common food-stuffs of India for ascertaining their nutritive values were also carried out.

Indian Central Jute Committee.—At its meeting held on 4th September, the Committee decided on the policy of collaboration with the Universities of Calcutta and Dacca and to co-opt some professors of the universities on its technological and agricultural research sub-committees. According to a press note issued by the Committee, the immediate objects of the collaboration are primarily twofold: (1) The Committee thought that the university scientists, many of whom were perhaps working on similar lines, might offer valuable advice on the work that was being done in the Committee's Research Sections. Even if their immediate work be different from the investigations that were being undertaken by the different technical sections of the Committee, they felt that their familiarity with the basic scientific methods and processes

might be of considerable help and value to the Committee's research workers. (2) The Committee were inclined to think that the universities, on their part, could also further their aims and objects by undertaking fundamental research on a number of subjects for which there was not, and indeed could not be, any room in the programme of work laid down for the different sections of the Committee. Such fundamental investigations might lead to results of far-reaching consequence which might be of abiding benefit to the jute industry of this country.

This policy will not involve the Committee in any financial commitments in advance. It will be open to the Committee to subsidise research at the universities, but only if, and to the extent, that its funds permit.

Jute Substitutes.—The intrusion of substitutes into the markets hitherto exclusively served by jute manufacturers is the industry's most pressing and difficult problem. Competition has recently been coming forward from cotton, sisal and paper interests, though the manufacture of paper bags has been largely curtailed as a result of the war. The extension of cotton substitutes has recently been noticed in France, Italy and more persistently so in the Argentine.

Among the substitutes which have received some attention, mention may be made of 'Jutital' and 'Ginster'. Tests on the former have not progressed beyond the experimental stage. 'Jutital' is the fibre extracted from the *typha* plant. Better progress has been made with 'Ginster' (furze) the acreage under which has recently been considerably increased by Italian authorities. In Spain, experiments have been successfully carried out on the use of *esparto* grass for packing cloth. A cloth consisting of 20 per cent. of hemp and 80 per cent. *esparto* is reported to possess desirable properties for use as packing cloth and in the manufacture of shoes.

Central Committee for Food Standards.—The report of the special committee appointed by the Central Advisory Board of Health, to study the questions relating to the prevention of food adulteration in India, came up for consideration at the last meeting of the Board, held at Poona (July 22–24), under the chairmanship of Sir Girija Shankar Bajpai. The Committee examined the problem of food adulteration from three aspects: (1) the technical, including food standards and technique of food analysis, (2) legislative, and (3) administrative. The Committee had so far examined only the technical aspect of the problem. Emphasis was laid on the fact that the improvement of methods of food analysis and the prevention of food adulteration in India, will have to be a continuous process and that the establishment of co-ordination between the provinces is a matter of utmost urgency. With this object in view the Board recommended the appointment of a standing committee to be called "The Central Committee for Food Standards" which would be in a position to advise the Central, Provincial and State Governments on all aspects of food adulteration. It is important that the standards suggested by the Committee should be acceptable to all the governments concerned, thereby facilitating inter-provincial trade and a uniform enforcement of food adulteration laws. One of the important functions of the Central Committee would be to issue from time to time "instructions" to public analysts incorporating the latest available information regarding methods of analysis.

The Centenary of the Polarimeter.—On the evening of the 7th September 1840, Jean Baptiste Biot described to the *Academie des* the rotatory power of liquids". D. Sidersky, the rotatory power of liquids." D. Sidersky, writing in the January-February number of the *Bulletin de l'Association des Chimistes* (p. 3), reminds us of this in an interesting survey of the birth and development of polarimetry. The science seems to have been made peculiarly their own by the French, at least in its early stages of growth, for the important modification of Biot's instrument by the introduction of two fields of view in juxtaposition, was made five years later by a compatriot, Soleil. Apart from this improvement, and the substitution of a Nicol prism as polariser by Ventzke in 1842, the polarimeter in its present-day form is substantially the same as that designed one hundred years ago by Biot.

It was in the course of his study of the optical activities of sugar solutions that Biot was led to produce his instrument, and less than ten years had passed before Clerget published his classical studies of the analysis of sugars, made with the aid of Soleil's "half-shade" modification. Since then the field of application of the polarimeter has greatly increased, but it still remains pre-eminently the tool of the sugar chemist and his colleague in the brewery. For those who are interested to know more of Biot's work we can recommend the reading of M. Sidersky's article, and of Biot's own account of it as given to the *Academie*, which is reproduced in the *Bulletin*.

(*J. Inst. Brewing*, 1940, **46**, 196.)

Physiographic Divisions of India.—The problem of dividing India suitably and with a view to serve all purposes, economic and others, is getting increasingly urgent. It is the business of Indian geographers to guide the country in this manner. Various proposals have been made for dividing the country suitably, but the method of physiographic division is the most suitable for all.

For instance, there is the redistribution of the political boundaries of India demanded by the people according to languages. Commenting on certain dynamic problems of India, Dr. A. Geddes said last year, "In view of the burning interest in peninsular India in the question of 'linguistic provinces', it may be well to mention certain related problems. The relation of language, of religion, and of other criteria of culture, not only to each other but to economic distribution can undoubtedly be clarified by conscientious use of *geographic method*. In Southern India, at this time, when few regard the internal political boundaries as either economic, just or final, I was struck by the rarity of any discussion of possible economic

provinces. The concept of the region and even the word is rarely met with. I have little doubt that, as the mapping of important distributions proceeds without slavish adhesion to existing political boundaries, geography can do much to guide the reformation of her internal political frontiers". No doubt the Madras Geographical Association has made a good beginning with local regional problems. Had we but succeeded in making a satisfactory division of India to serve such purposes, we, Indian geographers, would have got greater credit than what foreigners have been able to give us. In our efforts to do so, we are really helped by nature. When we know, for instance, how well the Province of Western Peneplains, proposed by me, includes all Gujarati-speaking people and the Deccan Trap Province all the Marathi-speaking people, the hope of making a division of our country physiographically to meet all our requirements could be fulfilled at last.

Even for the purposes of a Federated India, the scheme proposed by Sir Sikander Hyat Khan, of dividing India into certain zones, can be helped and improved upon by geographers, and the difficulty of bringing into the Federation, all the British Indian Provinces and the Native States, not as two distinct components but as integrated parts of a completed whole, can be solved on the regional basis. "It will encourage collaboration between contiguous units, i.e., both British Indian provinces and Indian States whose geographical proximity, common language and affinity of economic and other interests form natural ties to bind them together." So also in the matter of communications, sharing of economic resources, racial and cultural relationships, etc. Such physiographic divisions would be ideal and the services, rendered by Indian geographers to India in this connection, will be valuable. If Sir Sikander Hyat Khan's scheme of the seven zones is substituted by that of the 15 physiographic provinces proposed by me, it would serve the purpose well and an excellent uniformity could be attained from the points of view of representation and administration. It would, indeed, conduce to the solidarity of the whole country and the stability of the Central Government for all times. Let me hope that this dynamic problem will receive a satisfactory solution during the year 1940.

M. B. PITHAWALLA.

We congratulate **Dr. Maneck Bejanji Pithawalla**, D.SC., B.A., L.C.P., M.R.A.S., M.R.S.T., F.G.S., on his obtaining the D.Sc. degree of the Bombay University awarded to him for his researches in the science of geography. This is the first instance of such a distinction having been gained by an Indian scientist. Dr. Pithawalla's contributions have earned the warmest approbation of competent European authorities. His papers on "Physiographic divisions of India" and "A geographical analysis of the Lower Indus Basin" form notable contributions and provide the necessary stimulus to students and research workers in the much neglected field of geography. His example, no doubt, would be an inspiration to others. As Principal of the well-known institution, Bai Virbaiji Soparivala Parsi High School, he has exercised the great moral influence over the pupils whose warmest gratitude and appreciation he has won. Dr. Pithawalla has literary gifts which he has used in publishing works in prose and in verse on religious subjects which are acknowledged as works of great value.

Mr. M. Swaminathan, M.Sc., Chemist, Nutrition Research Laboratory, Coonoor, has been awarded the D.Sc. degree in Chemistry of the Madras University, for his thesis entitled "Nicotinic Acid and its role in Nutrition".

Mr. K. Subba Rao, M.Sc., has been awarded the degree of Doctor of Science in consideration of his work on the problem of Hysteresis in Sorption. A decade ago, the non-coincidence of the sorption and desorption curves was a puzzle amongst scientists. Investigations by Dr. K. Subba Rao in the Chemistry Laboratory of the Central College, on a variety of adsorption systems, using the McBain-Bakr quartz fibre spring technique, have established the remarkable permanence and reproducibility of the Hysteresis Loop. A new method of studying hysteresis, called by the author "Scanning of the Hysteresis Loop" has yielded results which constitute convincing evidence of the role of cavities with constricted ends, in causing the hysteresis in sorption. The "drift" in the hysteresis loop is explained as being due to the widening of cavities and their necks and a diminution in the total cavity volume, caused by the coalescence of the particles of the porous system, on progressive sorptions and desorptions. The disappearance of the hysteresis loop in the case of organo-gels is due to the elasticity of these gels, which swell on the imbibition of solvating liquids. A study of the rates of sorption of water on different porous gels has yielded further striking evidence in support of the cavity concept of hysteresis.

The degree of Doctor of Science has been conferred on **Mr. M. R. Aswathanarayana Rao, M.Sc.**, in consideration of his work relating to the iodides and oxy-iodides of sulphur. In chemical literature, it is stated that the iodides and oxy-iodides of sulphur have no existence. By the new method developed by Dr. M. R. Aswathanarayana Rao at the Central College, it has been possible to prove beyond doubt that these iodides can be prepared under special conditions, though they are highly unstable. The principle of the method is to treat a dilute solution of the corresponding chloride (*e.g.*, sulphur mono-chloride) in carbon tetrachloride with dry potassium iodide, taking care to minimise the decomposing effect of light. An ingenious spectroscopic method of confirming the existence of the iodides has also been developed by the author. The presence of these unstable compounds in carbon tetrachloride solutions has been proved by a carefully conducted study of the hydrolysis of the iodides by alkali.

By the application of this method, the following compounds (1) Sulphur mono-iodide, (2) Sulphur di-iodide, (3) Thionyl iodide, (4) Sulphuryl iodide and (5) Selenium iodide have

been prepared. The method is general in its scope and can be applied in the preparation of many unstable iodides that have not been isolated hitherto.

Calcutta University.—(1) Dr. H. J. Bhaba, D.Sc., has been appointed Special University Reader to deliver a course of ten lectures on "Cosmic Rays". The dates of the lecture will be announced later. (2) Mr. Manohar Ray, M.Sc., has been admitted to the degree of Doctor of Science in consideration of his thesis entitled "Studies in Fluid Motion".

The laboratory glassware, manufactured by *Messrs. The Scientific Indian Glass Co., Ltd.*, Calcutta, made from neutral and resistant glass, has been on the market for some time. The neutral glass, designated at "Sigcol" glass, has been tested at the Government Test House, Alipore, and reported as satisfactory. Its linear coefficient of expansion is $4{\cdot}8 \times 10^{-6}$, loss on boiling with N.NaOH for 3 hours, 44·1 mg. per 100 sq. cm., and loss on boiling with constant boiling HCl for 3 hours, 0·47 mgs. per 100 sq. cm. According to tests carried out in the laboratory of Prof. J. N. Mukherjee, D.Sc., University College of Science & Technology, Calcutta, *equilibrium water when kept in a flask for 24 hours does not suffer any change in specific conductivity.* It should thus satisfy most types of laboratory requirements. This pioneering venture in the manufacture of scientific glassware in India was started just two years ago and the well-known and enterprising firm, **Messrs. Adair Dutt and Co., Ltd.**, are the sole agents in India (except Bombay and Burma) from whom all relevant details can be had.

L & N Portable Universal pH Indicator.—The rapidity with which progress has been made in all branches of Science has been dependent upon the development of more accurate and more rapid methods of measurement of Physical quantities.

For several years **Leeds & Northrup Co.**, of Philadelphia, worked on pH Meters and ultimately constructed an instrument to meet the need for a compact, portable, Universal pH indicator. This instrument is accurate and direct reading not only with its own self-contained glass electrode but also with the quinhydrone, hydrogen or any other electrode following the Nernst equation.

Combining the accuracy and sensitivity of a laboratory instrument with the speed and convenience of a portable indicator, this Universal pH Indicator is entirely self-contained. It is obtainable in India from Messrs. *The Scientific Instrument Company, Ltd.*, Allahabad.

ASTRONOMICAL NOTES

Eclipse of the Sun.—A total eclipse of the Sun will occur on October 1. The path of totality begins in Columbia, South America, and passing through Brazil, the southern part of the Atlantic Ocean and South Africa ends in the Indian Ocean to the south of the island of Madagascar. The duration of totality in South Africa will be about four minutes. No phase of the eclipse will be visible in India.

Planets during October 1940.—Mercury will be low down in the western sky in the evenings and can be seen for a short while after sunset; on October 20, it will be at greatest elongation (24° 36′ East). Venus continues to be a morning star and is slowly approaching the Sun. Its brightness is decreasing, its stellar magnitude being −3·6 at the end of the month. Mars is near the Sun in the morning sky and is still in an unfavourable position for observation.

Jupiter and Saturn continue to be apparently close together and present an interesting spectacle in the sky for almost the whole night, the two planets crossing the meridian about an hour after midnight. Both are bright, the magnitude of Jupiter is −2·4 and that of Saturn 0·1. A conjunction of the two occurs on October 11, Saturn being 1° 17′ to the south of Jupiter. Uranus is in Taurus and reaches the meridian about two hours after midnight; it is about four degrees south of the well-known cluster Pleiades. Two occultations of stars by the Moon may be noted as likely to be of some interest—β Capricorni (magnitude 3·2) on October 9, and σ Leonis (3·8) on October 26.

T. P. B.

MAGNETIC NOTES

Magnetic conditions during August 1940 were less disturbed than those in the preceding month. There were 6 *quiet* days, 23 days of *slight* disturbance and 2 of *moderate* disturbance as against 11 quiet days, 16 days of slight disturbance, 2 days of moderate disturbance and 2 of great disturbance during August 1939.

The quietest day during August 1940 was the 30th and the day of largest disturbance was the 3rd. The characters for the individual days are shown below.

Quiet days	Disturbed days	
	Slight	Moderate
16, 21, 24, 25, 29, 30	1, 2, 4–8, 10–15, 17–20, 22, 23, 26–28, 31	3, 9

There were no magnetic storms during the month of August 1940, while there were three storms (two of great intensity and one of moderate intensity) during August 1939. The mean character figure for August 1940 is 0·87 as against 0·77 for August of last year.

M. R. RANGASWAMI.

SEISMOLOGICAL NOTES

During the month of August 1940 one great, three moderate and one slight earthquake shocks were recorded by the Colaba seismographs as against two slight ones recorded during the same month in 1939. Details for August 1940 are given in the following table:—

Date	Intensity of the shock	Time of origin I. S. T.	Epicentral distance from Bombay	Co-ordinates of the epicentre (tentative)	Remarks
1940		H. M.	(Miles)		
August 1 ..	Great	20 38	3990	45° N., 141° E., near Hokkaido Island, Japan	Reuter's news: 1300 fishing boats washed away by a tidal wave off the western coast of Hokkaido Island and much loss of life feared.
,, 13 ..	Moderate	21 07	3760	Near 34° N., 133° E., in or near Southern Japan	
,, 22 ..	Moderate	8 57	6570	Near 48° N., 165° W., to the south-east of Aleutian Islands	
,, 29 ..	Moderate	13 33	1630		
,, 30 ..	Slight	20 32	1870		

We acknowledge with thanks the receipt of the following:—

"Journal of the Royal Society of Arts," Vol. 88, Nos. 4562–65.

"Journal of Agricultural Research," Vol. 60, Nos. 2–7.

"Agricultural Gazette of New South Wales," Vol. 41, Pts. 7–8.

"Indian Journal of Agricultural Science," Vol. 10, Pt. 3.

"Biochemical Journal," Vol. 34, Nos. 5–6.

"Journal of the Institute of Brewing," Vol. 46, Nos. 6–7.

"Contributions from Boyce Thompson Institute," Vol. 11, No. 3.

"The Journal of Chemical Physics," Vol. 8, Nos. 6–7.

"Journal of the Indian Chemical Society," Vol. 17, No. 5.

"The Calcutta Reiew," Vol. 76, Nos. 1–2.

"Experiment Station Record," Vol. 82, Nos. 5–6.

"Indian Forester," Vol. 66, Nos. 8–9.

"Indian Forest Records," Vol. 6, No. 3.

"Transactions of the Faraday Society," Vol. 34, Nos. 230–31.

"Indian Farming," Vol. 1, Nos. 6–8.

"Genetics," Vol. 25, No. 1.

"Transactions of the Geological, Mining and Metallurgical Society of India," Vol. 11, No. 4, and Vol. 12, No. 1.

"Bulletin of the Indian Central Jute Committee," Vol. 3, Nos. 4–5.

"University of Illinois Bulletins," Vol. 37, Nos. 27–29.

"Review of Applied Mycology," Vol. 19, Pt. 6.

"Scripta Mathematica," Vol. 6, No. 4.

"Indian Medical Gazette," Vol. 75, No. 7.

"The Bulletin of the American Meteorological Society," Vol. 21, No. 5.

"Journal of the Mysore University," Vol. 1, Pts. 1–6.

"The Merck Report," Vol. 49, No. 3.

"Journal of Nutrition," Vol. 19, No. 6, and Vol. 20, No. 1.

"American Museum of Natural History," Vol. 45, No. 1.

"Nature," Vol. 145, Nos. 3683–87.

"Occasional Notes (Royal Astronomical Society)," No. 8.

"Indian Journal of Physics," Vol. 14, Pt. 2.

"Proceedings of the Royal Netherlands Academy, Amsterdam," Vol. 42, Nos. 7–9.

"Proceedings of the Royal Society of Edinburgh," Vol. 59, Pt. 3, and Vol. 60, Pt. 1.

"Journal of Research (National Bureau of Standards)," Vol. 24, Nos. 1–5.

"Canadian Journal of Research," Vol. 18, No. 6.

"Sky," Vol. 4, Nos. 8–9.

"Lingnan Science Journal," Vol. 19, No. 3.

"Indian Journal of Veterinary Science and Animal Husbandry," Vol. 10, Pt. 2.

"Science Forum," Vol. 5, No. 2.

CATALOGUES

Fisher Scientific Company (Castaloy Laboratory Appliances).

ACADEMIES AND SOCIETIES

Indian Academy of Sciences:

July 1940. SECTION A.—B. K. NANDI: *Experiments on the synthesis of compounds related to cinchonine and quinine.*—Some quinoline compounds that are structurally related to quinine and cinchonine have been synthesised starting from ethyl quinoline-3-carboxylate and ethyl 2-methoxy quinoline-3-carboxylate respectively. Although it has been found that these new series of compounds are effective against paramæcia, the cinchonine related series have however proved ineffective against avian malaria. T. VIJAYARAGHAVAN: *On decimals of irrational numbers.* BAWA KARTAR SINGH AND M. K. SREENIVASAN: *The kinetics of mutarotation of oxymethylene-d-camphor—Part II.* Traces of moisture accelerate the chemical changes involved in mutarotation catalytically. S. S. PILLAI: *On Waring's problem* $g(6) = 73$. S. S. PILLAI: *Waring's problem with indices* $\geqslant n$. R. D. DESAI AND (MISS) K. S. RADHA: *Studies in the Friedel-Crafts reaction—Part V. The action of acetic anhydride and benzoyl chloride on β-methyl resorcylate.* M. W. CHIPLONKAR: *Measurement of point discharge current during disturbed weather at Colaba.*—During the year there was an outflow of 30·6 millicoulombs of positive electricity from earth to air, and an inflow of 10·4 millicoulombs from air to earth. HANSRAJ GUPTA: *On the absolute weight of an integer.* S. S. PILLAI: *A note on Gupta's previous paper.* N. JAYARAMAN: *Alteration of tremolite to talc in the dolomite marbles of Yellandu, Warangal District (Hyderabad, Dn.).* During the alteration (*a*) almost all the calcium is lost, (*b*) water of constitution and alumina accumulate and (*c*) ferrous iron gets fully oxidised. It is suggested that meteoric solutions and atmospheric action were mainly responsible for the alteration. N. A. SHASTRI: *Some results involving Angelescu's polynomial* $\pi_n(x)$. C. V. RAMAN AND N. S. NAGENDRA NATH: *Quantum theory of X-ray reflection and scattering. Part I. Geometric relations.*—When X-rays fall upon a crystal, the characteristic vibrations of the crystal lattice may be excited thereby, in much the same way as in the phenomenon of the scattering of light in crystals with diminished frequency, the excitation being a quantum mechanical effect. B. DAYAL SAKSENA: *Analysis of the Raman and infra-red spectra of α-quartz.*—On the basis of the known crystal structure of quartz and the character table for the relevant point group, the symmetry modes of vibration of the atom groups in the unit cell are derived and geometrically represented, and their appearance in the Raman effect and in infra-red absorption is discussed in detail. These theoretical deductions are compared with an extended series of experimental studies on scattering in quartz, and the already known results of infra-red measurements.

July 1940. SECTION B.—I. FROILANO DE MELLO AND JONES DE SA VIEGAS: *The phenomena of dissociation into S and R forms observed among bacteria do also occur in yeast cultures.* M. A. BASIR: *Nematodes parasitic in Indian-cockroaches.* I. FROILANO DE MELLO: *A report on the characters and identification of the yeasts living in commensalism in the intestine of some laboratory animals.*

August 1940. SECTION A.—C. V. RAMAN AND P. NILAKANTAN: *Reflection of X-rays with change of frequency.—Part IV. Rock-salt.*—The experimental results support the expectation that the oscillation of the interpenetrating lattices of sodium and chlorine ions should vary the structure amplitudes of the crystal in such a way that the halved spacings which give strong unmodified reflections should also give strong modified reflections in the same order of relative intensity. B. K. SINGH AND A. B. LAL: *Studies on the dependence of optical rotatory power on chemical constitution—Part XVIII. The rotatory dispersion of stereo-isomeric 3. nitro-o-toluidino-, 5.nitro-o-toluidino-, 2:3-toluylenebisamino- and 2:5-toluylenebisaminomethylenecamphors.* S. S. PILLAI: *On normal numbers.* M. PRASAD AND S. S. DHARMATTI: *Molecular structure of some selenium compounds determined by magnetic method.* Se_2Br_2, Se_2Cl_2, H_2SeO_3, $Ag\,SeO_3$ and $SeOCl_2$ have been studied. S. S. PILLAI: *On a linear diophantine equation.* S. S. PILLAI: *On Waring's problem with powers of primes.* RAM BEHARI: *A theorem on normal rectilinear congruences.* P. RAMA PISHAROTY: *The Young's modulus of diamond.* The modulus in any direction lying in the octahedral plane is $5{\cdot}5 \times 10^{12}$ dynes/cm.^{2} The measurements were made by an improved "scale and telescope" method of Voigt. S. S. DHARMATTI: *Molecular structure of some tellurium compounds determined by magnetic method.* H_2TeO_3, $TeCl_2$, $TeBr_2$, $H_2TeO_4{\cdot}2H_2$, $(CH_3)_2TeI_2$, $(CH_3)_2TeCl_2$ have been studied. K. S. K. IYENGAR: *A property of integral functions with real roots and of order less than two.* B. K. SINGH AND A. B. LAL: *Studies on the dependence of physiological action on chemical constitution—Part I. Difference in odour of d-, l-, and dl- derivatives of amino- and bisaminomethylenecamphors.*

August 1940. SECTION B.—T. S. RAGHAVAN AND K. R. VENKATASUBBAN: *Studies in the South Indian Chillies—I. A description of the varieties, chromosome numbers and the cytology of some X-rayed derivatives in* Capsicum annuum *Linn.* J. J. ASANA: *Chromosomes of* Typhophtera donovani *don.* (*Tettigonidæ*). B. P. PAL AND T. NARAYANA RAO: *Ovule Mortality in Gram* (Cicer arietinum L.). SHRI RANJAN: *A Preliminary note on the X-ray Mutants of Pusa (52) Wheat.*

Indian Association for the Cultivation of Science *(Proceedings):*

April 1940.—N. BAGCHI: *The secondary K-Absorption Spectra of Sulphur.* S. DEB: *A note on the origin of the D-layer.* S. S. BANERJEE

AND A. S. RAO: *Production of Ultra-high Frequency Radio Waves by Electric Oscillations.* S. P. GHOSE: *Early Morning Variation of Ionisation and the True Height of Region F of Ionosphere.* M. RAMA RAO: *A Relation between Velocity of Sound in Liquids and Molecular Volume.* K. C. KAR: *The Theory of Compton Effect.* BISHNUPADA SAHA: *Rotational Raman Scattering in Liquid Oxygen.* S. P. RANGANADHAM AND M. QURESHI: *Magnetic Susceptibilities of Solutions of Sodium and Potassium Nitrates.* I. RAMAKRISHNA RAO AND Y. PARAMASIVA RAO: *Mutual Influence of Water and Heavy Water.* N. RAJESWARA RAO: *Electrolytic Dissociation in Sulphuric Acid as studied by Raman Effect.* CHANDRASEKHAR GHOSH: *Studies on some Indian Vegetable Oils—Part V. Temperature Effect on Gas Absorption and other Physical Properties.* HARIBANSH NARAYAN YADAV: *A Simple Laboratory Method of Producing Continuous Ultra-violet Light.*

Indian Chemical Society:

May 1940.—HANS RAJ KAPUR, KIDAR NATH GAIND, KARTAR SINGH NARANG AND JNANENDRA NATH RAY: *A new formula for chaksine, the alkaloid of* Cassia absus *and some experiments on its constitution.* B. K. NANDI: *Synthesis of Benzonicotine.* R. CHATTERJEE: *The alkaloid of* Berberis umbellata—*Part I. Isolation and examination of Umbellatine.* NRIPENDRA NATH CHATTERJEE AND GIRINDRA NATH BARPUJARI: *The influence of substitution on the formation of derivatives of* α*-Hydrindone and* α*-Tetralone. Synthesis of* 1: 2: 3: 4*-Tetrahydronaphthalene-*1: 2*-dicarboxylic acid.* S. VENKATARAMAN: *Compound formation in solutions—Part I. Pyridine and acetic acid.* W. V. BHAGWAT: *The reaction between aqueous iodine and sodium formate.* SANTI RANJAN PALIT: *Physical chemistry of resin solutions—Part I. Anomalous solubility of shellac and other resins in organic solvents.* K. P. BASU AND M. C. MALAKAR: *Iron and Manganese requirements of the human adult.* G. C. ESH AND S. S. GUHA-SIRKAR: *An investigation in soil and peat humic acids—Part I. Isolation and purification of the acids.* A. C. MAJUMDAR: *The effect of the injection of cobra venom on the ascorbic acid content of different tissues of the guinea-pig.* G. GOPALA RAO AND W. V. SUNDARA RAO: *Mechanism of* the microbiological oxidation of ammonia—Part III. M. Q. DOJA: *The cyanine dyes of the pyridine series.* A. L. SUNDARA RAO: *Distribution of trace elements in biological material.* S. K. MITRA: *A note on the isolation of anti-anæmic factor present in raw liver.* HEMENDRA NATH CHATTERJEE AND SURATH MOHAN GHOSH: *A note on the Lecithin content of the blood of Indian woman in normal condition and in pregnancy.* HEMENDRA NATH CHATTERJEE AND S. SEN: *A note on some of the electrolytes of the blood serum in normal Indians.* DURGA PADA CHATTERJEE: *A rapid method of estimating Tungsten in Tungsten steels.*

Royal Asiatic Society of Bengal:

August 5, 1940.—E. O. MURRAY: *Ancient workers of western Dhalbhum.* An interesting account of the copper mine working of the ancient people of the western Dhalbhum perganah, in the district of Singhbhum, in Bihar, has been provided. Remains of the ancient copper workers are numerous in the shape of countless working dumps and slag heaps testifying to their industry. Slag heaps and the remains of old clay furnaces lie all around and testify to a considerable output of copper at these points. The process of smelting was more or less the same as at present day, air being supplied by foot-worked leather bellows to clay furnaces about three feet high. R. RAKSHPAL: *Post-embryonic development of the respiratory system of* dialeurodes eugeniæ *Maskell (Homptera aleurodidæ) together with preliminary observations regarding the mechanism of respiration in the different instars.*

Meteorological Office Colloquium, Poona:

July 16, 1940.—L. A. RAMDAS: *A simple method of estimating the thermal conductivity of air near a water surface.*

July 23, 1940.—V. M. GHATAGE: *Model experiments on the relative motion of fluids of different temperatures.*

July 30, 1940.—K. NAGABHUSHANA RAO: *Atmospheric oscillations.*

August 13.—C. W. B. NORMAND: *The study of eviction and allied phenomenon with the help of Tephigrams.*

August 20.—S. V. CHANDRA SEKHARAIYA: *Physical principles of Radio Transmitters and Receivers.*

August 27.—K. R. RAMANATHAN: *Evaporation from water drops.*

Geological, Mining and Metallurgical Society of India:

The two recent numbers (Vol. 11, No. 4 and Vol. 12, No. 1) of the *Quarterly Journal of the Geological, Mining and Metallurgical Society of India* contain a number of short papers of varied interest. In the former, Mr. R. D. Godbole gives a brief account of the ground water conditions around Phonda in Deogad Taluq of Ratnagiri District and adjacent areas; and Messrs. K. K. Sen Gupta and J. Sen Gupta describe the Magnetite deposits near Daltonganj, with a note on their electric smelting. In the latter number, Mr. P. K. Chatterji writes about the economic geology of Jamalpur and its neighbourhood in Bihar. The paper on the Cherra-Nummulitic sequence near Cherrapunji by Mr. K. L. Das discusses the stratigraphical relationships of the Cherra sandstone to the underlying Cretaceous on the one hand, and the overlying Nummulitics on the other—thus throwing some light on the controversy regarding the exact age of the Cherra sandstone. Mr. K. Satyanarayana draws our attention to the occurrence of graphite at Majjivolum near Bissamcuttack Railway Station.

Bulletin No. 4 published by the Society deals with "The economic aspect of the Boulder bed in Radhaballavpur near Salanpur in Burdwan District." In this paper Messrs. K. K. Sen Gupta and J. Sen Gupta, after giving a brief account of the geology of this area, refer to the economic value of the gravels and fireclays found therein, giving some facts and figures.

1328-40—Printed at The Bangalore Press, Bangalore City, by G. Srinivasa Rao, Superintendent, and Published by B. N. Sastri, M.Sc., A.I.C., A.I.I.Sc., for the Board of Editors, "Current Science", Bangalore.